The combination of Glass and Ceramics as a means of artistic expression in studio practice

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PhD Abstract (2009)

This practice-led research investigates the feasibility of combining glass and ceramics in a hot state, as a means of artistic expression in studio practice. Glass and ceramics have many related material qualities and are processed in similar ways. Chemically they are alike however structurally they are very different, which creates compatibility problems when they are combined in a hot state. Through controlled processing, material properties can alter when each is partially converted into the other. It is recognised by artists in the field of studio ceramics that porcelain can partially convert into a glassy form when high fired to create a translucent material. Likewise it is recognised in the field of industrial engineering that glass can partially convert into a ceramic form when processed in a controlled way to create a glass-ceramic material; this material is not used by practitioners and would be difficult to develop in a studio environment. A total of 43 contemporary practitioners were found that worked in both glass & ceramics in their work. Of these only 16 practitioners combined glass and ceramics in a hot state, the majority combined them in a cold state to avoid compatibility issues. It became apparent that there is a distinct lack of published material on the combination of glass and ceramics in studio practice. It was the aim of this investigation to address this gap by identifying and testing potential hot state processing routes. This research addresses these issues through a *multiple-method* approach rooted in creative practice; directed by the following aims:

- To develop the practical and creative parameters of the combination of glass and ceramics in a hot state.
- To demonstrate and articulate the possible creative and practical benefits of the new processing routes as a model for practitioners in the field.
- To articulate the significance of the research methods and results through the mapping of the field.

Material testing was focused on artistic practice and experimentation which identified the creative parameters of combining glass and ceramics in a hot state, four potential process routes that combine glass and ceramics in a hot state were identified and tested. This testing was further extended and supported by the application of compatibility studies, which helped to match the expansion rates of glass and ceramics when they are combined. Bone china was identified as the closest fit to glass in terms of expansion rates; quartz was added to further improve the fit of the materials. Case studies of artists that work in glass and ceramics have been used to position the research within the field. New insights have emerged into the combined processing of glass and ceramics in a hot state. This approach offers a series of potential processing routes to be viewed as a model for others in the field. The final submission includes a thesis, a series of materials tests, and a body of related artworks that demonstrate the hot state combination of the materials.

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Author declaration

According to the regulations, I declare that during my registration I was not registered for any other degree. Material for this thesis has not been used by me for another academic award.

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I would like to thank the University of Sunderland for giving me the opportunity to complete my PhD. A joint glass and ceramic degree course has been run in Sunderland since 1982, it has grown into a large department, and renowned centre for postgraduate studies; with some of the best-equipped workshops in Europe. The specialist facilities and technical advice of the department was one of the main features for basing this research project at the University of Sunderland.

I would especially like to thank my Director of studies, Professor Kevin Petrie (PhD) and my co-supervisors Professor Sylva Petrová (PhD) and Professor Brian Thompson; who with their expertise and support have tirelessly directed me throughout my studies. Thanks are also due to Professor Beryl Graham (PhD) who led my research training and to Professor Peter Davies for his constant advice. I would also like to thank my technical advisors Dr David Taylor, Dr Doug Crozier, Dr David Gelder and Dr William Carty. I would also like to thank Mike Saul (previously senior lecturer in Ceramics) and the late Dr Colin Gill (previously senior lecturer in Materials Science) who initiated this Doctoral project. Thanks are also due to the technical support staff of the Department: Tim Betterton, James Maskrey and Robert Winter for their advice and assistance. I am very grateful for the help and support that I have received throughout this research project. I am very thankful to my case study artists who took part in this research project in particular Professor Steve Dixon and Criss Chaney who carried out the collaborative projects. I am also very appreciative to:

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- The *European Keramik Work Centre* (EKWC), in the Netherlands for inviting me to participate in the *Piet Stockmans Masterclass*
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1. Introduction

This Chapter describes the starting point for this research project, outlines the research field and establishes the possible significance of combining glass and ceramics in studio practice. It also discusses research problems, possible solutions, aims and objectives and practical approaches and methods which have been used. Finally, it states the components of the work which constitute the research submission.

1.1 Background to the initiation of this research project

This research deals with combining the two materials of glass and ceramics in a hot state within studio practice as a means of artistic expression. The starting point developed from a series of sculptural glass and ceramic artworks created for my final undergraduate show in 2001 (see Figure 1) since graduating, the theme of combining glass and ceramics has held fast as an inspiration and technical challenge which has continued to be a core part of my professional practice. Using this experience as a starting point I hoped to develop a model for others that would expand the creative potential of combining glass and ceramics in studio practice; as well as extending my own practice to help articulate the potential artistic value of working in both materials. My early work involved the cold state combination of glass and ceramics either by gluing or juxtaposing the materials. It has however been the intent of this research to move away from cold state combination towards hot state techniques, to create a homogenous bond by heating both of the materials together in a kiln or by using hot glass techniques.

Figure 1 Kelly, 2001, 'Balanced', slip cast porcelain & blown glass cane, 35 x 55 x 7cm Photographed by John Donoghue

It has become evident throughout my own academic experience and through advice received from my peers that crossovers in practice occur when glass and ceramics are studied together. Over the years, the Glass and Ceramic department (at the University of Sunderland) has observed a number of undergraduate and postgraduate students combining both glass and ceramics in their practice. This has been observed mainly in the undergraduate faculty, which offers a joint Bachelor of Arts degree in 'Glass and Ceramics'. In their first year, students study a range of modules which provide a basic training in both mediums. It has been observed anecdotally by my peers and I that the nature of the undergraduate work produced in both glass and ceramics were limited due to the associated incompatibility issues of combining the materials. This could perhaps be attributed to the relatively short time frame of a BA degree (3 years) which makes it difficult for students to overcome technical issues such as those encountered in the combination of glass and ceramics; in fact many have felt that it is a near impossible task. It has transpired that the situation is unclear and that there is much debate about whether the hot state combination of glass and ceramics is actually possible.

1.2 Outline of the Research Field

Glass and ceramics are generally viewed by craft practitioners as two separate disciplines which are rarely combined in studio practice, as most practitioners prefer to focus on just one discipline. They are however, often taught together in higher education and placed alongside each other in museums and galleries and a small number of artists have been found that work in both materials. Three sectors have been identified in which glass and ceramics share the same context: higher educational institutions; museums and galleries; and artistic practice.

In terms of higher education institutions, only two undergraduate and one postgraduate combined *Glass and Ceramic* degree courses were identified in the United Kingdom. It became apparent that *Applied Art* courses are more widely spread in the United Kingdom; offering a broad range of disciplines including glass and ceramics which are taught alongside metalwork and jewellery. Ten Undergraduate and eight postgraduate Applied

Art degree courses were identified. The *Applied Art* route is less specialised and encourages students to work across a range of disciplines; such as combining metal and glass. It was observed that the most conventional route was the teaching of just one discipline, either ceramics or glass. In total, three Undergraduate and five Postgraduate glass courses and eight Undergraduate and seven Postgraduate ceramic courses were identified (see Appendix 1).

In examining the sector of museums and galleries; only three institutions were identified that specialise in the exclusive display of just glass and ceramics. This indicates that it is unusual for the two disciplines to be classified in this way. More commonly glass and ceramic collections are housed together within Applied Arts or Decorative Arts collections; thirty institutions were identified that display joint collections of both glass and ceramics. There are also institutions that have been built to house and promote just glass or ceramics (see Appendix 2). Additionally, there are various organisations which have been set up specifically to help glass and ceramics practitioners; such as the *Ceramic and Glass Circle of Australia* and the *Ceramistes et Verriers l'annuaire.*[1] This again supports the claim that glass and ceramics often share the same context.

The final sector examined is artistic practice; this research focuses on the identification of contemporary practitioners that combine glass and ceramics. A total of forty-three artists were found that used both glass and ceramics in their studio practices (see section 2.3). Only sixteen artists were found that combined glass and ceramics in a hot state. It is apparent that their results were not always successful as incompatibility in the materials surfaces was visible in the form of stresses and cracks. The majority combine them in a cold state to avoid compatibility issues. It is apparent that glass and ceramics are not often combined in studio practice, indicated by the scarcity of artworks that combine glass and ceramics in an historical or contemporary context.

[1] For more information see (www.ceramicsglasscircleaustralia.org) and (www.ceramique.com)

At an early stage in the research it was decided not to investigate the combination of glass and ceramics in a cold state; which would employ cold assembly techniques such as UV gluing or simple juxtaposition[2]. A cold state combination was considered outside of the research study and not an ideal way of combining glass and ceramics. Additionally, other routes of combining glass and ceramics such as lampworking were also considered outside of the research study, as they were not part of the researchers own studio practice. It was the aim of this investigation to identify and address the gaps and problems associated with hot state combination of glass and ceramics, by identifying and testing potential hot state processing routes for practitioners in the field.

1.3 Research problems: Disadvantages associated with the combined processing of glass and ceramics in a hot state within studio practice

The following research problems have emerged from both my own professional experience as a glass and ceramic artist and from viewing the work of other artists in the field. This review has suggested that there are significant gaps in the existing knowledge, understanding and practice of combining glass and ceramics in a hot state within studio practice. It is apparent that there is little literature directly related to the hot state combination of glass and ceramics. This can be attributed to the general lack of published technical material studies aimed at studio craft practitioners. Problems relating to definition and theory, as well as practical processing techniques; demonstrated a need to enhance studio practice within this specialist field. The main practical disadvantages associated with the combined processing of glass and ceramics in a hot state are:

- The structural differences of glass and ceramics related to their varying rates of expansion which creates incompatibility, in the form of excessive cracks or stresses in the combined body.

[2] Although early on some cold state artworks were created to realise design ideas (see section 1.2).

- The difficulty of controlling the process of partial conversion of either material into the other which would involve high refractory temperatures and specialised equipment.[3]

It was established that many artists avoid these issues by combining the two materials in a cold state by gluing or juxtaposing them to create a perceived fit. It has been the goal of this research project to address and challenge this way of working by purposefully combining the two materials in a hot state and by making technical and visual improvements, new insights into artistic practice have emerged.

1.4 Possible solutions: The potential for overcoming the problems associated with combining glass and ceramics in a hot state within studio practice

In principle, it is recognised that porcelain can partially convert into a glassy phase when high fired to create translucent effects. It is also known that through a controlled process of crystallisation, glass can be converted into a partially crystalline (ceramic) form. It was the main aim of the practical testing phase of this research to identify potential routes of combining glass and ceramics in a hot state and to improve the applications of these routes in artistic practice. Principally, this has involved the introduction of potential ways of working (routes), which have been put into practice in the studio. At the initiation of this research project very few contemporary artists were found that combine glass and ceramics in a hot state in studio practice; this remains the case as only sixteen artists have so far been identified. However, of the twenty-six that work in a cold state, it was decided that these artists could perhaps use this research to possibly extend the range of approaches within their practices. This research could also be of benefit to emerging students who may want to combine glass and ceramics in their degree work but who would not necessarily have the technical understanding to do so.

From the onset of this project, it was important to define the main assessment criteria for any combined system of glass and ceramics. This

[3] Specialised equipment such as high refractory crucibles, furnaces and kilns.

was set out as the technical quality and visual qualities of the work and the ease and method of production used. It was established that these factors would determine if the research and emerging artworks were a practical model for others working in the field. It was necessary to create artworks that tested the practical aspects of the new system, as well as the usefulness of the work in terms of artistic vision.

As a possible solution, it was decided that the apparent incompatibility of the materials could be partially resolved by locating a compatible clay body that matched the expansion rate of glass. It was determined early on that the issues of controlling the partial conversion of either material using high temperature controls was beyond the technical constraints of the studio environment and was therefore outside the scope of the research. The research would not set out to conduct tests that required specialised equipment as this would exclude most studio practitioners' and could not be transferred as a model for others in the field. This is a practice based research project, carried out from my perspective as a glass and ceramic practitioner, not as a scientist or historian. Historical and scientific data have however been consulted and used to support and inform the research.

1.5 Aims of the research

From this rationale the following three research aims were developed:

Aim 1 To develop the practical and creative parameters of the combination of glass and ceramics in a hot state.

Aim 2 To demonstrate and articulate possible creative and practical benefits of the potential processing routes as a model for practitioners in the field.

Aim 3 To articulate the significance of the research methods and results through the mapping of the field.

1.6 Objectives of the research

The aims of the research and the methods for the research (see section 1.7) led to the development of the following three objectives:

Objective 1 To identify and test possible potential process routes that combine glass and ceramics in a hot state.

Objective 2 To create a body of combined glass and ceramic tests and artworks.

Objective 3 To create reference points by mapping the links between glass and ceramics to aid the positioning of the research within the field of studio glass and ceramics.

1.7 Overview of research methods used

As a starting point, initial tests were carried out to locate the parameters of the research and to plot potential process routes (see section 3.4). From this more in depth testing was required in order to resolve difficulties that arose in processing and firing. To measure the practicality and aesthetic output of the research, a range of forms and surface effects were created using the potential process routes which were then applied to a series of artworks. Compatibility studies were carried out on a series of clay bodies to establish which body was closest to the expansion rate of glass. This information was then used to select the most suitable clay body for the research project. Further tests were also carried out with the addition of quartz silica sand which was added to the porcelain and bone china clay bodies to improve the materials fit with glass. It was established that bone china was the most suitable clay body found for combining glass and ceramics in a hot state (see section 3.7).

To demonstrate the creative possibilities of the potential process routes a range of artworks were developed in order to position the work in a professional context within the field of glass and ceramics. Several bodies of work were submitted to galleries; for example, a *Crafts Council Solo Showcase* of the emerging artworks was held in 2006 at the National Glass Centre, in Sunderland. This helped to disseminate the work to professionals and peers in the field, as well as exposing the emerging artworks to a wider public domain (see section 4.3).

This section will set out an overview of the research methodology applied to aid the selection of appropriate research methods. As previously stated, this research project was approached from a practice based perspective to provide insights into the creative possibilities of combining glass and ceramics in studio practice. A search into emerging methodology in Art and Design research was carried out as part of the postgraduate research training programme. A table of completed PhDs in the disciplines of glass and ceramics was formulated. [4] This helped to determine what constitutes an Art and Design research project. In total, sixteen were found that related to the field of ceramics and seven that related to the field of glass. Of the twenty-three, completed PhDs listed none were directly related to the combination of glass and ceramics (see Appendix 3).

A review of the literature related to research methodology aided the selection of appropriate research methods. A range of methodological approaches were reviewed; which revealed the methods for data collection and how other researchers in the field of Art and Design have framed their research questions and undertaken their research. From the outset this research project has been viewed as a process of discovery based on the experience of studio glass and ceramic practice. This has involved the following theories: tacit knowledge (Polanyi, 1967, p.4), experiential learning (Kolb, 1984, p.41) and reflective practice (Schön, 1983, p.138) which have been applied to provide a deeper understanding of the creative process and in turn the potential of combining glass and ceramics. Through a tacit understanding of technique and material qualities (linked to sensory knowledge), the research process has been constructed (through experimentation) and then reflected upon to reveal new insights into combining glass and ceramics within artistic studio practice.

[4] The list was limited to PhDs completed only in the United Kingdom.

Dormer (1997, p.147) discusses the inherent relationship craft has with tacit knowledge, '*Craft relies on tacit knowledge'* and how craft is passed on by people through working together through demonstrations and conferences or through educational institutions. He goes on to discuss the nature of artistic practice which is fuelled by the desire to keep finding new or different ways of making and understanding craft objects. This has influenced the direction of the study which has been to promote knowledge transfer and to provide a potential model for others in the field. As well as seeking to reveal the practical knowledge of the research by detailing the methods used to create the tests and artworks.

A key influence in the early stages of selecting a suitable research methodology which supports the theories previously discussed was Gray & Malins (2004) who encourage research students to engage in active exploration of the research process in relation to practice and context of the research; from the perspective of experiential learning within a constructivist paradigm. The use of experiential learning has become apparent in the emerging test and artworks (see Chapter 3 & 4) of this research project which open up and explore my personal interest and motivation to combine glass and ceramics in my work. The tests and artworks produced demonstrate the varied creative possibilities of combining glass and ceramics and offers solutions to the problems associated with combining glass and ceramics. It is as yet unknown how this body of work will be used by others in the field; it may be possible to publish the work as a guide to students and artists in the field.

Gray and Malins (1995, p.2) discuss (at the time) the relative infancy of formal Art and Design research. Taking the view that the methodological approach between fine art, craft and design are generic and can benefit from sharing approaches and experiences and that the practice based research process is also a learning process. Practice based research can be viewed as a pro active means of research, where practitioners research through action and reflecting in and on action and eventually reflecting for future action. The practitioner is central to the inquiry as is the critical context in which the research is taking place. Malins and Gray (1995) claim that it is necessary as part of the research process that practitioners initiate critical analysis and debate in order to formulate theoretical and philosophical frameworks for themselves. This informed, intimate perspective leads to a greater degree of insight only possible from experiential, 'tacit' knowledge – through engagement with craft practice.

Drawing upon this, the selection of the chosen research methods employed a pluralist approach which involved the application of a 'multiple-method' technique. Emergent Art & Design research methods were identified and customised to the individual needs of the research project. The selected research methods were used to demonstrate and address the individual aims and objectives of the research and to articulate the significance of the research results. The following methods were identified and employed throughout the research process: observation, visualisation, action and reflection in and on action – through critical self assessment, dialogue and interaction with peers, personal constructs and participant-observation. The above methods were put into action by using the following methods: sketchbooks, technical notebooks, journals, photography, 3-D models.

In addition focused methods such as visual mapping (see section 2.3) and case studies (see Chapter 5) were used to analyse the research and draw reference points in order to position the research within the field. Questionnaires were generated as part of the case studies; which examine contemporary artists that combine glass and ceramics in their practice. This helped personal constructs to be formed which related this research project to the field of study and collaborative projects were then developed. The decisions made and the criteria applied to the research were generated by the researcher and have been re-considered and reflected upon as this research project has developed. The experiential knowledge that has been gathered throughout this research project has been used as a means of understanding the practice of creating and controlling tests and artworks using methods of experimentation and *trial and error*. The creative parameters of combining glass and ceramics in a hot state have been directed by a tacit, sensibility for the visual aesthetic and physical properties of the materials. A visual map and timeline of the methods used and their relationship to each other was created (see Appendix 13).

1.8 Components of work which constitute the research

- A written dissertation stating the principles and description of work undertaken.
- A body of combined glass and ceramic artwork, presented for reference at examination, which is represented in this thesis by photographic illustrations.[5]

5 Please note that all illustrations included in this thesis function as reference points to the issues which they illustrate and must be seen as a guide. To fully understand the discussed subtleties of the visual qualities of the actual objects referred to they should be ideally viewed by the reader in person; as the results of this practice based research project are based on visual outcomes.

2. Contextual Review

This Chapter relates to Aim 3 of the research: to create reference points by mapping the links between glass and ceramics. The contextual review is divided into four sections: the literature related to the combination of glass and ceramics in studio practice, the literature that links the early historical context of glass & ceramics from 1500AD – 1000BC and the later context from 1400 – 1975. Finally, the literature related to contemporary practitioners that combine glass & ceramics from 1975 – 2009.

2.1 Literature related to the combination of glass and ceramics in studio practice

The main research topic was defined as the combination of glass and ceramics in contemporary studio practice. In order to clearly define the vocabulary of the emerging visual language, it was necessary to set out the terms that were to be used in the literary search. Acknowledging and recognising the diverse terms for processing techniques was essential for the accurate analysis of the art practices reviewed. Key words that were used in the initial search were: *Glass, ceramics, clay, glass-ceramics, combined, joint, mixed, translucent, transparent, light, studio, practice, art, design and craft*. Using this topic definition, a quick search was carried out in the Art and Design library at the University of Sunderland. Quick referencing was used to search for texts held by the library; as well as search engines accessed through the internet.

There is limited published literature on the combination of glass and ceramics in studio practice. Bray (2000) is a practical resource aimed at studio practitioners. However, it does not show examples or practical methods of how to combine glass and ceramics in a hot state. No formal postgraduate research into: the combination of glass and ceramics in a hot state has been identified. Several online searches were conducted for example on the *index to theses* website and on the Alfred University *Scholes* website.[6] Three examples of related research were found Aylieff (1995) Binns (2007) and Mulcahy (2009).

Felicity Aylieff conducted an MPhil at the Royal College of Art, which focused on the use of aggregates in ceramics and the search for the 'elusive body' i.e. the most suitable clay body for combining materials such as glass, grog, obsidian and granite with the clay body in a hot state (see Figure 2).[7]

Figure 2 Aylieff, 1995, 'Fruit' Press moulded ceramic with porcelain aggregates & glass

David Binns ongoing research into combining glass and aggregate materials started in 2000, when he carried out some initial tests at the International Ceramics Studio in Hungary; which he resumed as part of his ongoing research at the University of Central Lancashire and later published (Binns, 2007, pp.21-23). His work involves introducing different aggregates such as glass to a composite aggregate mix, which are then combined in a hot state into large scale sculptures. Binns' work is predominantly made of recycled glass with varying additions of mineral aggregate (see Figure 3).[8]

Figure 3 Binns, 2006, Waste mineral aggregate & recycled glass 38 x 48 x 8cm

Of the three research projects identified Binns was the most relevant to this research project; although his work has not been published in an academic forum.

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[6] For more information see (www.theses.com) and (www.scholes.alfred.edu)

[7] Aylieff's work will be discussed further in this chapter (see section 2.3.5) as part of the literature related to contemporary artistic practice.

[8] Binns' work will be discussed further in this chapter (see section 2.3.1) as part of the literature related to contemporary artistic practice and in more detail as a case study in Chapter 5.

Jenny Mulcahy conducted a practice based PhD at the James Cook University, in Townsville, Australia which she completed in 2009. Her research project was concerned with the defunct uranium mining industry, in Queensland. Her research was predominantly concerned with an investigation into creating new clay bodies adding sawdust, perlite and vermiculite to the mix. She explored the visual phenomena and essence of silence of the abandoned site; using a range of materials in her work including found objects, ceramics, metal and glass which she combined in a cold state (see *Figure 4*).[9]

Figure 4 Mulcahy, 2004, 'Inheritance' from Mary Kathleen Series 2, hand built ceramic and cast glass

In order to articulate the position and scope of the research reference material was collated that related to the combination of glass and ceramics in an historical and contemporary context; which was presented in a chronological format. The literary search and subsequent review was used as evidence to lead the rationale for the research aims and objectives.

2.2 Literature related to the early historical context of glass and ceramics: from 1500AD – 1000 B.C and from 1400 – 2009

In order to understand the context of the early historical field of glass and ceramics it was important to ascertain the origins of each material. Ceramics can be traced back to the first Neolithic period (c.3500 to 200 B.C.), which significantly predates the origins of glass which can be traced back to ancient Mesopotamia (1500 to 1000B.C). It has been deduced by archaeologists and historians that many of the techniques of glass making were most likely developed from ceramic techniques.

[9] Mulcahy's work will be discussed further in this chapter (see section 2.3.2) as part of the literature related to contemporary artistic practice and in more detail as a case study in Chapter 5.

For thousands of years, glass and ceramics have been closely linked through the process of glazing on ceramics. *Egyptian faience* ware dates from around 4000 B.C. it is a non-clay ceramic made mainly of quartz or sand which was made into beads that looked like the semi precious stones of lapis lazuli and turquoise (Vandiver & Kingery, 1986, p.19). *Egyptian paste* is another ancient Egyptian material that was developed and is one of the earliest forms of glaze found on ancient ceramic objects, such as beads, amulets and scarabs again made in a characteristic turquoise colour. During the drying process soluble salts migrate to the surface of the object which melts to form a glaze during the firing (Bray, 2000 p.56).

Figure 5 Vase, 18th Dynasty, 1400-1300 B.C. Egypt Turquoise & opaque cobalt blue, yellow, white, with translucent cobalt blue; core formed, trail decorated. H. 10.7cm. Collection of the Corning Museum of Glass, Corning, NY (66.1.213).

Egyptian perfume bottles and vases are among the first examples of core formed objects where glass objects are formed around a soft ceramic core; the ceramic is then removed leaving a hollow glass form (see Figure 5). These techniques indicate that the origins of glass making developed directly from ceramic processes; as discussed below by Cummings (1997, p.28):

> *Prior to its emergence as a totally independent material, it seems likely that glass was used as a subservient element to ceramic, particularly used and developed as glazes to surface clay objects. The fact that when glass became a separate material it was worked through intermediate processes like fritting, encourage this view and the early development of core forming, which can be seen as a step from glazing.*

Stern (1998, pp.189-191) also discusses the relationship between glass and ceramics from the beginning of the glass industry in the 16th c. B.C. until the end of the 4th c. A.D. Stern examines areas of interaction that related to glass working, the shared techniques, the use of clay in the glass working process and the imitation of decorative glass techniques in faience and ceramics. An unusual link which she considers is the connection between the potters wheel and the techniques of 'wheel-tooling' in the Hellenistic period, 2nd c. B.C to the 1st c. A.D. and 'wheel-molding' in the Roman period from the late 1st c. B.C. to the 4th c. A.D; which she attributes to the German glass artist Rosemarie Lierke. The techniques described by Stern suggest an early form of press moulding [10] or centrifuge [11] casting; she also proposes that glassblowing tools were originally made from ceramics.

In considering the historical relationship between glass and ceramics it is of significant interest to this research project to consider the drive that shaped and evolved the shared histories of these two materials. This link is exemplified in opaque or 'opaline'[12] glasses which can be traced back to Egyptian times and have been used throughout history in various forms. The Venetians produced a 'lattimo'[13] glass in the mid 15th century which featured fine threads of white glass developed by adding tin and lead lime to the glass batch. In the 17th century, European glassmakers expanded the production of 'milk glass' or 'porcelain glass' to imitate Chinese porcelain (see Figure 6), as glass was a far cheaper material to produce: the Germans produced a 'porzellanglas' or 'milchglas' (Bray, 1995, p.177) and in 1663, Crafft introduced 'beinglas'[14] to northern Europe, produced with bone ash (Loibl, 2008 pp.67-68). In the 1690s, Perrot also made opaline glass based on porcelain designs in Orleans, France (Kingery, 1986 p.171).

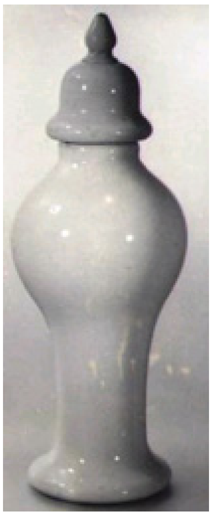


Figure 6 Milk Glass Jar with cover, 1770-1799, 19.7 x 8.4 cm Collection of the Corning Museum of Glass, Corning, NY, (55.2.5)

These examples draw a close technical and aesthetic link between glass and ceramics. The creation of glass objects that directly imitate porcelain is an interesting historical precedence; which has been of significance to this research project and has inspired the use of white glass in the creation of a range of artworks (see Chapter 4). Glass is also renowned for its ability to imitate many materials such as the opaque, lustrous qualities of semi precious stones; which dates from ancient Mesopotamia. In the 17th century

[10] A machine which presses glass into moulds using a plunger, can be either automatic or operated by hand, which are commonly used in industrial glass manufacture to create cheap replicas of cut glass.
[11] A machine which shapes hot glass by using centrifugal force to force molten glass against the inside of a mould.
[12] A term for any glass with a white, milky appearance.
[13] Glass canes containing twists of coloured glass threads.
[14] Also known as bone glass.

crystal and ruby glasses were made to look as if they were made from naturally occurring rock crystal and precious ruby stones; a high value material which was ranked alongside porcelain (Von Kerssenbrock-Krosigk, 2008, p.123). This demonstrates the revered luxury status of both glass and ceramics.

Hailed as 'white gold', porcelain was viewed as the ultimate commodity; largely because its production techniques were unknown in Europe and it had to be imported at great expense from the Far East. Led by key scientists and alchemists of the time the race to master porcelain was a serious business. An intensive period of research ensued catalysed by the introduction of chemical research and principles to the study of ceramics. In the late 16th century, Italy led the way with a soft paste porcelain or *pâte tendre* called 'Medici' porcelain; France had the first break through with the development of a commercial soft paste porcelain at Sèvres; finally in 1708 this was rivalled with the development of a hard paste porcelain in Meissen, Germany (Kingery, 1986, pp.154–163). In 1795, Josiah Spode created one of the first Bone China bodies consisting mainly of bone ash (Clark, 1995, pp.79-81).[15] In 1740, Réaumur carried out extensive research on the chemical composition of Chinese porcelain; motivated by D'Entrocelles famous letters of 1712 – 1722 relating to the composition of Chinese hard paste porcelain. He developed an opaque glass known as *Réaumur* porcelain a type of crystalline ceramic which today would be classified as a 'glass-*ceramic',* as described below by Kingery (1986, p.171):

> *Réaumur proposed rather to take ordinary window glass and pack it densely in a powder of calcined gypsum and quartz, a mixture which maintained the shape when it softened and also nucleated crystal growth from the surface. Luted in a fired ceramic container and fired in an ordinary terracotta kiln, the glass crystallized to form what has been referred to as Réaumur's porcelain, and described as a "fibrous" glass.*

Réaumur's use of quartz and window glass is of particular relevance to the compatibility studies[16] which were developed later on in this study (see section 3.8). Réaumur's pioneering work has been an important historical

[15] Note the use of bone ash in glass production in 1663 (as previously discussed) appears to predate the use in Bone China.
[16] These studies added quartz to the bone china body to improve the fit with the glass.

precedence when looking at the shared relationship of glass and ceramics. Scientists and artisans have continued to develop their own theories and artistic goals extending the parameters of the field. The chemical theories which emerged have greatly influenced the development of ceramic and glassmaking techniques; which have gone on to have far reaching applications in industrial engineering and within artistic practice.

The influence of chemistry and alchemy on the development of glass and ceramic production established the foundation for the new technologies that we know today. Historically the role of glass and ceramics was to create decorative added value vessels and objects, now they are used in high technology in varied applications to fulfil advanced technical needs[17] and in artistic terms as independent art forms.

Glass truly became an independent artistic process in the form of the kiln cast glass technique of *pâte de verre*[18]. This technique remained unknown for many years until French ceramicists revived it in the 19th century; among the first to rediscover this technique was Henri Cros and his son Jean working at their studio at the Sèvres Porcelain Manufactory (see Figure 7).

Figure 7 Cros, 1886, Plaque with female figure Pâte de verre, Manufacture de Sèvres H13.5cm Collection of the Corning Museum of Glass, Corning, NY, gift of The Steinberg Foundation (96.3.23)

Other ceramicists inspired by this spirit for material research were Françoise Décorchemont, George Despret, Albert Louis Dammouse, Almeric Walter and Argy Rousseau who all went on to develop their own carefully guarded independent versions of *pâte de verre* (Layton, 1996, p.18). The fact that these artists were able to use their specialist ceramic knowledge to rediscover an ancient technique demonstrates the close relationship that

[17] Glass-ceramics are used in liquid crystal display screens, optics and telescopic lenses, cooker hobs, cookware and missile nose cones.
[18] An ancient Egyptian and Phoenician technique used to shape objects of glass with moulds.

exists between ceramics and glass; and the combined history that these two mediums share.

In the 19th century glass and ceramics were heavily industrialised and cheap mass produced designs flooded the market. In response to the industrial revolution, the *Art and Crafts* movement emerged; of which studio pottery was the leader. The influence of this movement on independent artistic endeavour can be seen in the work of George E. Ohr and the Martin brothers; who were credited as the first studio potters of around 1900 (De Waal, 2003, p.35); although the term studio pottery did not come into use until the 1920s. In comparison, independent glass studios were scarce and glassmaking in the main remained tied to industry and its technical support; designers were reliant on skilled craftsmen to execute their designs for them.

It is of interest to consider at this point the theories of Pye (1968, pp.20-24) who discusses the nature of craft and workmanship: '*the workmanship of risk*' and '*the workmanship of certainty'*. His approach repositions the separation between craft and industry, to redefine what is carried out by hand and what is done by machine. He claims that what is done by hand is a certainty; however if a designer is in the hands of a craftsmen they are not truly experiencing the process and cannot therefore make the same aesthetic judgements which involves a degree of risk.

In the late 19th century and the early 20th century the French artists René Lalique, Emil Gallé, Henri Navarre and Maurice Marinot and the American artist Louis Comfort Tiffany are credited as pioneers of the modern day studio glass movement (Layton, 1996). In addition, many European designers and artists worked with industry from the 1920s onwards and are cited as early examples of studio glass. Exemplified by the work of: Simon Gate and Edward Hald at the Orrefors Glass Factory in Sweden; Kaj Franck, Timo Sarpaneva, and Tapio Wirkkala at the Ittala Glassworks in Finland (Opie, 1989) and Pavel Hlava, Jan Kotik, Adolf Matura and Rene Roubicek at the Borske Sklo Glassworks, in the Czech Republic (Petrová & Olivie, 1989). These designers and artists were all still practicing within the confines of a factory; it was not until the 1960’s that glass blowing was adapted to small scale studio production.

In 1962, the US ceramicist Harvey K. Littleton led workshops and seminars on hot studio glass at The Toledo Museum of Art, in Ohio. Littleton in collaboration with Dominick Labino, a research chemist, developed a formula for glass that could be melted at a low enough temperature in a single-pot furnace (Layton, 1996 pp.26 – 30). This innovation set the scene for the international studio glass movement which led glass making away from the factory, creating a new generation of independent studio glass artists.

This movement towards an independent route of artistic expression started to blur the boundaries between craft, design and fine art. As these boundaries merged so did the boundaries between studio glass and ceramics opening up new creative possibilities; including the potential working of these two mediums in combination. Tracing the routes of artists who work in both glass and ceramics it was possible to draw insights into their artistic journeys, working methods and artistic vision; which directed this research project. From the onset of the studio glass movement many ceramicists changed discipline to work in glass; leaving ceramics behind. Although the development of artists working in both materials is the focus of this research project; there is mileage in understanding how artists came to work in glass and how this has influenced their work. The studio glass movement was pioneered by ceramicists who developed glassmaking as an independent studio craft. When glass became a feasible studio option many more ceramicists transferred to studio glass; finding many similarities in production techniques and processes of this new studio medium.

It is evident that the studio glass movement developed partly from studio ceramics and the established knowledge instilled within the field of ceramics. This change in direction can be seen in the metamorphosis of ceramicist to glass artist. Ceramicists Charles Bray, Samuel Herman, Peter Layton, Harvey Littleton and Ovia Toikka all converted to glass, their departure from ceramics was crucial to the development of the studio glass movement. Many of the forerunners of the studio glass movement had in depth ceramic knowledge which was practically applied when setting up glass studios within educational institutions. Exemplified by Harvey Littleton who started teaching Glass in 1962 at the University of Wisconsin, USA (Layton, 1996, p.26), Samuel Herman who started teaching glass in 1969 at the Glasshouse Studio, for the Royal College of Art, London (Layton, 1996, p.38) and Charles Bray who set up the glass department in 1982, at the Sunderland Polytechnic College, Sunderland[19] (Swann, 2001, p.10).

Figure 8 Bartron, 2004, White Cylinder, Blown glass and enamels

Most of these developments took place within educational institutions supported by an environment of learning. This progression has actively influenced artists and students to combine glass and ceramic materials and processes. Perhaps in line with this movement there are a number of contemporary glass artists whose artworks appear to imitate or parallel the qualities of ceramics; the following artists were identified: Paula Bartron, Criss Chaney, Meike Groot and Yoshiaki Kojiro (see figure 8 – Figure 11). It appears that the visual relationship between glass and ceramics continues to be a source of inspiration and as seen in these works a means of expressing new material qualities.

Figure 9 Chaney, 2008, 'Crackle bowl', Blown Glass and enamels, 15 x 15cm

[19] Now known as the University of Sunderland.

The blown glass work of Chaney[20] and Groot when viewed together immediately draw distinct parallels; as does the dense surface of Bartron's blown vessel. All use thickly applied enamels with delicately devitrified or oxidised surfaces; which links these artists to a ceramic style.

Figure 10 Groot, 1994, 'Blown Form', Blown glass and enamels, 27cm

The cast glass work of Kojiro is another interesting approach (see Figure 11) his work resembles cracked white ice and has visual qualities similar to that of vitrified porcelain or plaster (Oldnow, 2006, p.73).

Figure 11 Kojiro, 2007, 'Incidents', Kiln formed sculpture 41 x 41 x 33cm Collection of the Corning Museum of Glass, Corning, NY, gift of The Steinberg Foundation (96.3.23)

There are also distinct parallels to a ceramic style by glass artists who employ *pâte de verre* techniques such as Joan Crous, Deborah Horrell and Michele Perozeni. Crous and Horrell appear to use the vessel as a metaphor (see Figure 12 & Figure 13), to create still life assemblies whereas Perozeni uses the sculptural form to create uniquely delicate art objects (see Figure 14). Crous' installation is of specific interest, created using thick glass powder which was heavily applied to delicate blown glass forms and then re-fired. These works have a distinctive ceramic feel yet they have a beautifully opaque surface that subtly absorbs light (De Beaumont, 2008, pp.46-49).

Figure 12 Crous, 2008, 'Cenae 9 L'Alchimie du Verre', blown glass powder kiln-fired, created as part of a residency at the Musée-Atelier du verre à Sars-Poteries

[20] For more information on Chaney see (http://www.crisschaney.com). Chaney and Bartron's work will be discussed further in chapter 5 (see section 5.5).

In 2006, Horrell took part in the *Clay Fusion: Ceramists Work in Glass* exhibition at the *Bullseye Connections Gallery*, in Portland, Oregon. This showcase introduced ceramicists to new glass making techniques in collaboration with the *Bullseye* Glass Company. Other ceramicists who took part were Tom Kearcher, Jim Koudelka, Judy Hill, Thomas Orr, Ted Sawyer and Theodore W. Vogel (Bullseye, 2006, pp.4-6). This exhibition supports the claim that glass and ceramic practice are closely aligned and that crossovers in practice are of benefit to artists.

Figure 13 Horrell, 2002, 'Still life - Up, Down, Up', Pâte de verre glass 27 x 44 x 25cm

Perozeni's pâte de verre sculptures have a beautiful luminous quality that appears to exude an inner light. They resemble natural forms such as cocoons or bark, made from white glass which is fired to incorporate a range of translucent to dense opaque effects (see Figure 14). Perozeni creates an ambiguous message about the materials she works in (Boissel, 2004, pp.28-33).

Figure 14 Perozeni, 2005, 'Metamorphose de blancs' Pâte de verre glass, 42x22x20cm

In addition to artists imitating the qualities of ceramics in their glass work, there are glass artists such as Pavel Homolka who uses other materials to contrast with the visual qualities of glass (see Figure 15). He uses concrete as a mould into which he casts his glass forms to create sculptures with a contrasting opaque glass core (Petrová, 2001, p.192).

Figure 15 Homolka, 1988, 'Babylon II' Cast glass into concrete mould, 20cm

The recent work of June Kingsbury is also of relevance, which involves the kiln casting in glass of road kill animals; in which the bones of the animals are encapsulated within the piece (see Figure 16). This is of particular significance to this research project and draws parallels to the early use of ground bone in both opaline glass and Bone china (see section 2.2). Kingsbury has previously worked separately in both glass and ceramics.

Figure 16 Kingsbury, 2006, Kestrel, Squirrel, Songthrush, Rook, 2006, glass, found objects, 10cm x 26cm x 72cm

The work of all of these artists has been influential to the emerging visual aesthetic of this research project and to the understanding of their work within the wider research context.

2.3 Literature related to contemporary practitioners that combine glass and ceramics from 1975 – 2009

Artists combining glass and ceramics within studio practice can be traced back to the 1970s and 1980s; although most of the artists identified can be dated to the mid 1990s to the present day; this demonstrates that artists were and are actively seeking crossovers within their practice. There is very little formal literature on contemporary practitioners that combine glass and ceramics perhaps because most of the artists are not producing formal research. The following reference points were traced initially through secondary sources such as journals, exhibition catalogues, blogs and websites. The majority of the references were taken from the following specialist glass and ceramic journals: *Neue Keramik* (1989-2009), *Ceramic Review* (1999-2009), *Ceramics Art & Perception* (1999-2009), *Neues Glas* (1989-2009) and *La Revue de le Ceramique at du verre* (1981 -2009). As well as, the online US journal: *Ceramics Monthly* (www.ceramicsmonthly.com). Due to a lack of published literature focused web searches were conducted, to find additional information on artists that combine glass and ceramics in their work.

Due to the constraints of the research time frame it was not always possible to access primary sources by viewing the work directly in collections or current exhibitions; which made it difficult to understand how some of the work was actually made. This was elucidated somewhat by sending questionnaires to the contemporary practitioners who were asked specific questions about their processing methods (see chapter 5). This was then discussed further through email discourse and in some cases a studio visit. Unfortunately not all of the practitioners contacted wanted to answer the questionnaire this could be attributed to language barriers or because they did not want to share their specialist knowledge.

A literary search was carried out to indicate which contemporary practitioners work was in progress and which practitioners work had already been created that related to the research. The literature search demonstrated that glass and ceramics are rarely combined in studio craft practice, so far only forty-three [21] contemporary artists were found that worked in both materials; these artists were organised into four groups:

1. Artists that combine glass in a hot state with ceramics (16)
2. Artists that combine kiln glass in a cold state with ceramics (17)
3. Artists that combine hot glass in a cold state with ceramics (8)
4. Artists that combine sheet glass in a cold state with ceramics (2)

Additionally, a further eleven practitioners were found to be outside of the above groupings. They were arranged into the following two groups, artists that have combined glass and ceramics in the past, but have chosen to specialise in one material and artists that are no longer practising.

5. Artists that are no longer combining glass and ceramics as they have specialised in one material (7)
6. Artists that are no longer combining glass and ceramics and as they are no longer practising (4)

[21] Please note that it was difficult to settle on a final number as artists can be hard to trace if they do not exhibit internationally or if they have not been widely published. This should therefore be seen as a relative survey of the field within the research time frame.

These artistic groups suggest a sector that has not been formally presented in such a way, which could perhaps be nurtured and initiated by this research project by offering a potential model for others working in the field. The research could also be of benefit to emerging art students as well as more established artists working in both glass and ceramics. As it could possibly extend their artistic practices and technical understanding relating to combining glass and ceramics within their studio practice.

A thematic approach was used to show the links and similarities in the selected works of the above identified artists. Visual mapping was used to represent the practitioners, their country of origin and the type of work that was reviewed (see Table 1 – Table 6). From this process it was possible to see immediately which practitioners were central to the study and which were more on the edges or external to the study. This method provided evidence and the initial starting point for the Case Studies (see Chapter 5). The visual map made it possible to divide the practitioners into distinct groups and helped with the positioning of this research project within the field. Additionally of the fifty-four artists that were identified in total, it was possible to clearly see the country of origin of each artist, there was one artist from Australia, three artists from the Czech Republic, twelve artists from France, four artists from Germany, one artist from Iceland, one artist from Italy, two artists from Japan, three artists from the Netherlands, one artist from Turkey, thirteen artists from the United Kingdom and thirteen artists from the United States. It is of significance to the research that thirteen of the identified artists were from the United Kingdom; which suggests that the research would be of interest and benefit to this group of practising artists. It perhaps also suggests that the approach of combining glass and ceramics is (to some extent) fostered by the UK art scene; which sees artists working across disciplines. Higher number of artists were also found in the US and France which suggests a similar scene.

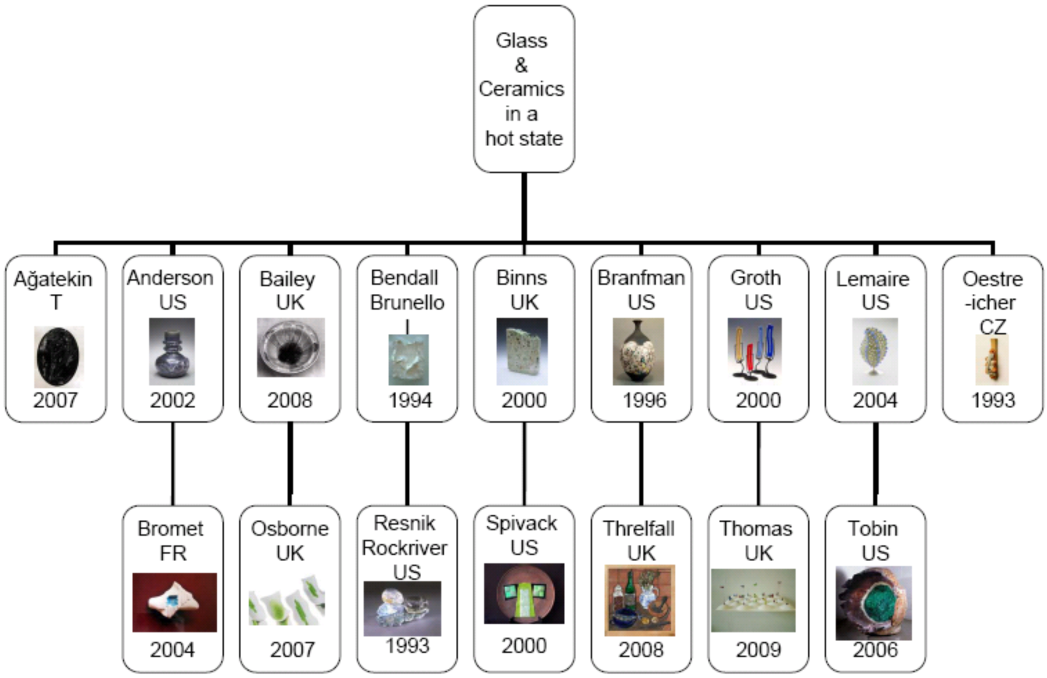
2.3.1 Artists that combine ceramics with glass in a hot state

Glass and ceramics (as previously discussed), have been closely linked through the process of glazing on ceramics for thousands of years. Several artists have attempted to extend this relationship between ceramics and glass moving from surface glazing to create a more equal hot state combination of glass and ceramics in their work; often creating work which has compatibility issues with a 'crackle' effect. Common glaze faults[22] (Bray, 2000, pp.120 - 138) that occur in glazed surfaces can be compared to this effect. Specifically, in the instance of *crackle* glazing where crazing is deliberately induced to create crackled surfaces. This glaze technique could be viewed as a precursor of the 'crackle' effect, exemplified below by some of the artists who have established a distinct *crackle* effect in their work which occurs due to compatibility issues between the two materials.

Sixteen artists demonstrate in their work the visual qualities and practical attributes of combining ceramics with glass in a hot state: Ağatekin, Anderson, Bailey, Bendall Brunello, Binns, Branfman, Bromet, Groth, Lemaire, Oestreicher, Osborne, Resnik Rockriver, Spivack, Threlfall, Thomas and Tobin; their work will be discussed in detail below.

[22] Such as glaze fit, crazing, peeling, shelling and flaking, crawling and surface tension.

Table 1 Visual Map of Artists that combine ceramics with glass in a hot state [23]



A recent artist to exemplify this approach is Mustafa Ağatekin, who uses ceramic materials as an inclusion material in his glass artworks (see Figure 17), which he combines in a hot state by fusing different layers together. No visible cracks or stresses can be seen in his work which suggests that his system is compatible. He first started to combine both materials in his work in 2007, he went on to publish his research in the Australian journal *Ceramics Technical* (Ağatekin, 2009, pp.16-20).

Figure 17 Ağatekin, 2007, 'Secret series' Fused sheet glass and ceramics 29 x 43cm

[23] The dates refer to when the artists first started to work in both materials

The ceramicist Nathan Anderson started to combine hot molten glass with his wheel thrown ceramics in 2005; a technique which he named ‘Glasku’. Visible cracks can be seen in the glass surface which is used to create a *crackle* effect (see Figure 18). He first started to add recycled glass to his glazes melting them in raku firing in 2002.[24]

Figure 18 Anderson, 2005, ‘Glasku’ Wheel thrown raku & hot glass

In contrast, Mike Bailey uses a range of glass sources to make his work including glass buttons, off-cuts, marbles, beach glass and pebbles which he fuses onto his ceramic vessels in a hot state (see Figure 19). Visible cracks can be seen in his work which he exploits as a *crackle* effect. He first started to combine both materials in his work in 2008, which he went on to publish in the UK journal *Ceramic Review* (Bailey, 2009, pp.65-67).

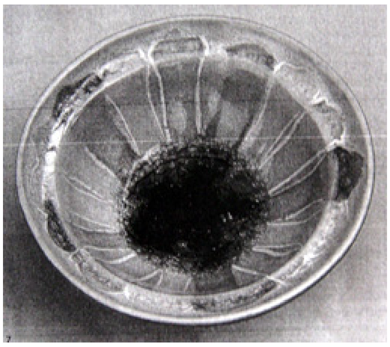


Figure 19 Bailey, 2009, Pooled blue, green and clear glass beads fired on rim of bowl

Tiziana Bendall-Brunello uses garments to explore the fragility and the presence of the body. She creates delicate sculptures in slip cast porcelain over which she slumps sheet float glass, no visible cracks or stresses can be seen in the surface of her work (see Figure 20 & Figure 21). She first started to work in both materials in 1994. [25]

Figure 20 Bendall-Brunello, 1998, Detail of ‘Fragments’ slip cast porcelain & sheet glass

[24] For further information see section 5.3.1 or see (http://glasku.blogspot.com), so far no published information has been found on Anderson.
[25] For further information see (http://www.tizianab-b.co.uk), so far no published information has been found on Bendall Brunello.

Figure 21 Bendall-Brunello (1998) 'Fragments' slip cast porcelain & sheet float glass

As previously discussed (see section 2.1), David Binns adds glass to his composite mix of mineral aggregates, which he fires into large scale sculptures. The process involves kiln-casting waste mineral aggregates such as grog, granular refractory materials and found materials which he combines with recycled glass in a hot state (see Figure 22). No visisble cracks or stresses can be seen in his work which suggests a compatible system. He first started to combine glass and ceramics in his work in 2000, he went on to publish his research in French journal *Revue de la Ceramique et du verre* (Binns, 2007, pp.21-23).[26]

Figure 22 Binns, 2006, Waste mineral aggregate & recycled glass

Claude Bromet started combining glass and ceramics in a hot state in 2004 (see Figure 23), a *crackle* effect can be seen in his work which displays visible stresses. He uses a high fired ceramic setter into which he fires coloured glass frit. He also creates designs in porcelain and crystal for industry, which are combined in a cold state. Bromet's work has been widely published and was featured in the French newspaper *Le Populaire du France* (Bonilla, 2008, pp.7-8).

Figure 23 *Bromet, 2004, 'Les Bijoux' Porcelain and blue crystal*

[26] For further information on Binns see section 5.3.2.

A slightly different approach is that of Steven Branfman, who has developed an inlaid technique that involves pressing glass chips into the sides of wet hand thrown vessels. They are then high fired to create colour and texture in a range of his raku work (see Figure 24). The glass melts to form a series of multi coloured glassy glaze runs. Small stresses can be seen in the surface of the work which suggests that the system is incompatible. He first started to combine glass and ceramics in his work in 1996, he went on to publish his research in the US journal *Ceramics Monthly* (Branfman, 2002, pp.9-13).[27]

Figure 24 Branfman, 2002, Inlaid coloured glass with brushed clear raku glaze, raku fired

In contrast, John Groth has developed a clay body that is compatible with the expansion rate of glass. His artworks combine clay and Bullseye glass in a hot state fusing them together to create sculptural forms which are then mounted on metal bases (see Figure 25 & Figure 26); no visible cracks can be seen in the surface of his work, he started to work in both materials in 2000.[28]

Figure 25 Groth, 2000, 'Desk 4 Up Gang', Sheet glass & ceramic, on a metal stand

Figure 26 Groth, 2000, 'Dance', Sheet glass & ceramic, on a metal stand

[27] For further information on Branfman see section 5.3.3.
[28] For further information see (http://www.johngrothglass.com), so far no published information has been found on Groth.

A similar approach is that of Amy Lemaire, who employs bead making techniques to fuse soda lime glass to her high alumina stoneware ceramic forms in a hot state (see Figure 27). No visible tension or cracks can be seen in her work which suggests that her materials are compatible. She first started to combine glass and ceramics in her work in 2004, she went on to publish her research in the US journal *Ceramics Monthly* (Reichert, 2006, pp.48 – 51).[29]

Figure 27 Lemaire, 2004, 'Bead Pod', Soda lime beads and stoneware, 10 x 5cm

Helly Oestreicher fuses sheets of float glass to her ceramic forms in a hot state (see Figure 28). A distinct *crackle* effect can be seen with visible stress marks. She also uses extruded ceramic elements in terracotta and stoneware which she assembles in a cold state with the sheet glass to create her sculptural work; she started to work in both materials in 1993 and is one of the earliest examples of an artist working in such a way.[30]

Figure 28 Oestricher , 2001, 'Cocon I', Terracotta & sheet glass

A similar approach to Bromet (see Figure 23) is that of Sally - Anne Osborne, who works mainly with unglazed porcelain or bone china as a setter for small chips of coloured glass frit to emphasise the matt and gloss surfaces of the materials (see Figure 29). A visible *crackle* effect can be seen in the surface of these pieces which suggests that the system is incompatible; she first started to work in both materials in 2004.[31]

Figure 29 Osborne, 2007, Detail of slip cast bone china & glass frit.

[29] For further information on Lemaire see section 5.3.8.
[30] For further information see (http://www.euronet.nl), so far no published information has been found on Oestreicher.
[31] For further information on Osborne see section 5.3.10 or see (http://www.ozziart.co.uk), so far no published information has been found on Osborne.

A contrasting approach is that of Sally Resnik Rockriver, who generates hot state chemical reactions in her blown glass and ceramic artworks (see Figure 30); she creates 'geochemical formations' through high temperature crystal growth. She started using melted glass on her ceramics in 1993 to form crystalline glazes and in 1996 she started applying ceramic glazes to hot blown glass; along with Oestreicher (see Figure 28) she is one of the earliest examples of this approach. She went on to publish her work in the US journal *Ceramics Monthly* (Resnik Rockriver, 2004).[32]

Figure 30 Resnik Rockriver, 2002, 'Gestation' glass & ceramics geochemical sculpture

Alfred Spivack has developed a technique which fuses coloured dichroic glass to biscuit fired thrown stoneware vessels which he combines in a hot state (see Figure 31 & Figure 32). Slight cracks and stresses can be seen in the surface fusion of his early work which he used to create a *crackle* effect. His latest work does not have any visible cracks or stresses which suggests that his system is compatible. He started to work in both materials in 2000, he went on to publish his research in the US journal *Ceramics Monthly* (Spivack, 2007, pp.1-3).[33]

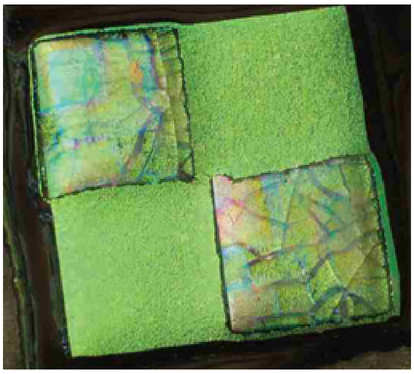


Figure 31 Spivack, 2007, Detail stoneware platter, bronze glaze & dichroic glass

Figure 32 Spivack, 2007, 'Green Kimono' stoneware platter, glaze & dichroic glass

[32] For further information on Resnik Rockriver see section 5.3.12.
[33] For further information on Spivack see section 5.3.13.

Like ceramicist Bailey (see Figure 19), Philippa Threlfall uses glass which she sets into her ceramic murals, her ceramics are made of earthenware which she fires glass frit into in a hot state (see Figure 33). Visible cracks and stresses can be seen in her work which suggests that her system is incompatible however she uses this to create a *crackle* effect. She started to work in both materials in the 1990s and her work went on to be published in the UK journal *Ceramic Review* (Bailey, 2009, p.66).

Figure 33 Threlfall, 2008, 'Still life in Ash Frame' Dimensions 60cm x 61.5cm

A recent graduate from the Cardiff School of Art and Design, Claire Phillips Thomas developed a series of work that combines slip cast ceramics, paper pulp and slumped glass (see Figure 34). The ceramic is pierced at the leather hard stage and biscuit fired, the glass is then melted through the pierced holes to create runs of glass. The result is a series of colourful glass drips flowing through a ceramic form; she started to work in both materials in 2008. [34]

Figure 34 Thomas, 2009, Degree show work, white earthenware slip & slumped glass

US sculptor, Steve Tobin works in a range of materials including bronze, steel, glass and clay. To make his ceramic works he sets explosives into raw clay as the explosion takes place spheroid forms are created; the work is then fired with glass at its core in a hot state (see Figure 35). A distinct *crackle* effect can be seen on the surface of these pieces, which suggests that his system is incompatible. He started to work in both materials in 2006 and his work has been widely published and was featured in the Australian journal *Ceramics Technical* (Grande, 2007, pp.4-8).

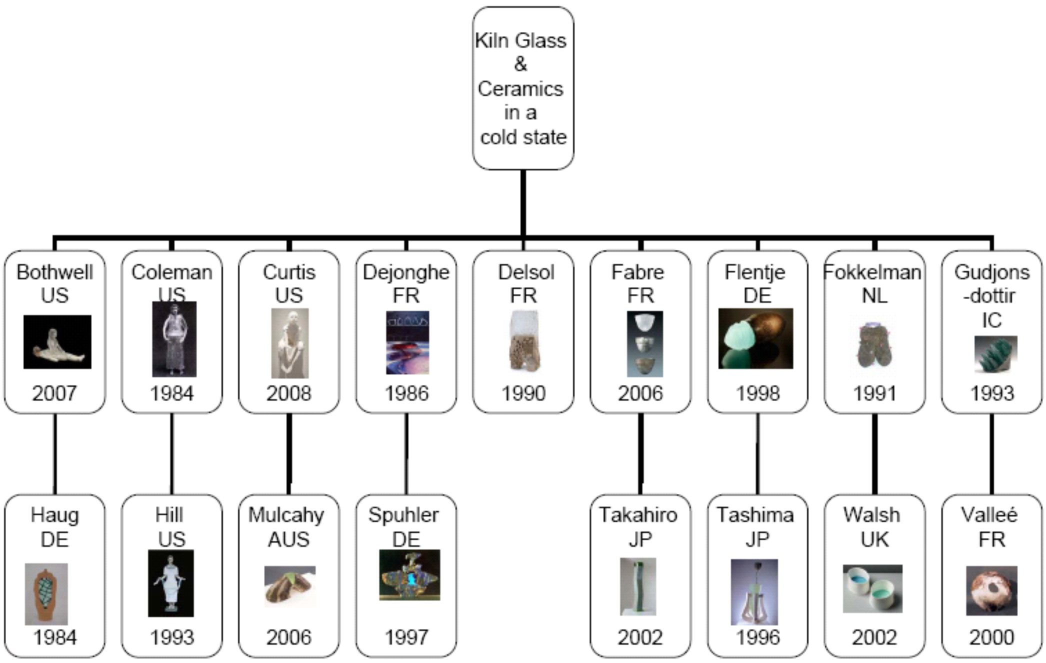
[34] For further information see section 5.3.15, so far no published information has been found on Phillips Thomas.

Figure 35 Tobin, 2006, 'Exploded Earth' Ceramic & glass

2.3.2 Artists that combine kiln cast glass with ceramics in a cold state

No artists were found that combine ceramics and kiln cast glass in a hot state. However, seventeen artists demonstrate in their work the visual qualities and practical attributes of combining ceramics and kiln cast glass in a cold state: Bothwell, Coleman, Curtis, Dejonghe, Delsol, Fabre, Flentje, Fokkelman, Gudjonsdottir, Haug, Hill, Mulcahy, Spuhler, Takahiro, Tashima, Walsh and Valleé; their work will be discussed in detail below.

Table 2 Visual Map of Artists that combine kiln cast glass with ceramics in a cold state [35]



[35] The dates refer to when artists first started to work in both materials

An artist that exemplifies this approach is Christina Bothwell who combines cast glass and raku fired ceramics which she assembles in a cold state (see Figure 36). She creates figurative sculptures which portray the processes of birth, death, and renewal. She started to work in both materials in the early 1990s; her work has been widely published and was featured in the US journal *Glass Art Quarterly* (Yood, 2005, p.56).

Figure 36 Bothwell, 2007, 'While you are sleeping' Cast glass & raku fired ceramic, 22cm

A similar approach is that of Elizabeth M. Coleman, her figurative sculptures are mainly created in porcelain, but also brick clay, glass, wax, paper and found objects which she assembles in a cold state (see Figure 37). She is one of the earliest examples found; she started to work in both materials in the early 1980's and her work was featured in the US journal of *New Glass Review* (Oldnow, 1985, p.75).

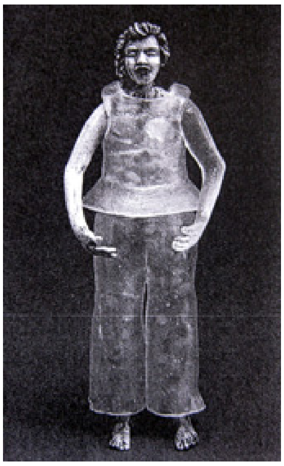


Figure 37 Coleman, 1985, cast glass, porcelain & seed corn, 18 x 7.5 x 7cm

As is the approach of Gary Curtis, who combines cast glass and ceramics, which he assembles in a cold state to create childlike figures made from raku with cast glass heads. His work depicts figures that have a fragile and ephemeral quality (see figure 38); he has worked in both materials since the late 1990's.[36]

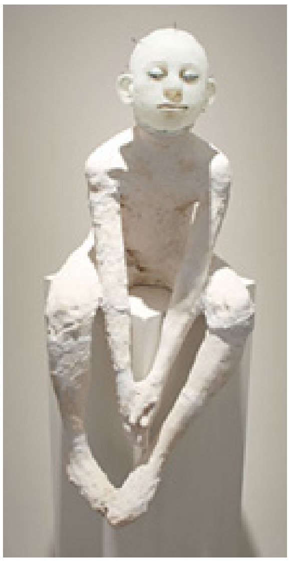
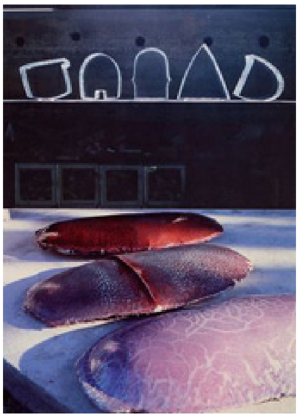


Figure 38 Curtis, 2008, 'Seated Figure 3' Ceramic & cast glass, 35.5 x 33 x 84 cm

[36] For further information on Curtis see (http://www.davidsongalleries.com), so far no published information has been found on Curtis.



Bernard Dejonghe is an established ceramicist and glass artist. He first began to work in clay in 1968 and in glass in 1986, although he never combines the two materials in the same composition (see Figure 39) only in juxtaposition. Dejonghe's work has been widely published and was featured in the French journal *Revue de la Ceramique et du Verre* (Atkins, 2005, pp.26 – 27).

Figure 39 Dejonghe, 2004, 'Areshima series' Kiln cast glass & stoneware, 175x75x15cm

In contrast, Edmeé Delsol works in both cast glass and raku fired ceramics which she assembles as one piece in a cold state. She first began to combine glass in her work in 1990 (see Figure 40). Her work is about the contrasts between the transparent and opaque qualities of the materials. Her work has been widely published and was featured in the Autsrialian journal *Ceramics: Art & Perception* (de l'Epine, 1999, pp.25-27).[37]

Figure 40 Delsol, 1990, Cast glass & raku fired ceramic

Christine Fabre works predominantly in raku fired ceramics; in 2006 she started to work in kiln cast glass (see Figure 41. She combines the materials by juxtaposing them in the same composition. Her work has been widely published, her first use of glass was featured in the German journal *Neue Keramik* (Praudel, 2006, pp.8-10).

Figure 41 Fabre, 2008, 'Triptic' Kiln cast glass & raku fired ceramics

[37] For further information on Delsol see section 5.3.4.

In a similar approach to Delsol (see Figure 40), Almut Flentje combines raku fired ceramics and cast glass techniques which she combines in a cold state (see Figure 42). Self taught she started to work with clay in 1997 and then glass in 1998; her work was featured in the German journal *Neue Keramik* (Flentje, 2001, pp. 456-459).

Figure 42 Flentje, 2000, 'Fusion 2' Kiln cast glass, raku ceramics 5 x 12cm

Hanneke Fokkelman combines small cast glass elements with her organic stoneware forms in a cold state (see Figure 43). She started to work in both materials in the 1990s, her work was featured in the French journal the Revue de la Ceramique et du verre (De Beaumont, 2007, pp.50-52).

Figure 43 Fokkelman, 1991, Untitled, Stoneware ceramics & cast glass, 37 x 30cm

A similar approach is that of Kristin Stina Gudjonsdottir, who creates mixed media abstract sculptures in cast glass, ceramic, metal and stone, all of the work is made from reused materials and found objects and is assembled in a cold state (see Figure 44), she started to work in both materials in 1993.[38]

Figure 44 Gudjonsdottir, 2000, 'Feelers: Found light', Stoneware ceramics & cast glass

[38] For further information see (http://www.art.net/~stina) or see section 5.3.7, so far no published information has been found on Gudjonsdottir.

Nica Haug is a German ceramicist who works predominantly in ceramics; she often incorporates found glass objects such as wine bottles in her abstracted sculptures which she combines in a cold a state (see Figure 45). She started to work in both materials in the early 1980s and like Coleman (see Figure 37) is one of the earliest artists found to be working in this way , her work was featured in the publication *Ceramic Figures* (Flynn, 2002).

Figure 45 Haug, 1984, 'Netzwerk figur', Stoneware ceramics & recycled glass

Judy Hill is an American glass and ceramic artist, she creates doll-scale figures made of kiln-cast glass and raku fired ceramics; which she combines in a cold state (see Figure 46). Her self-portraits are emotional studies which reveal and conceal private natures. Hill explores the fragility and contradiction of being human through her figures. She started to work in both materials in the early 1990s; her work has been widely published and was featured in the US journal the Urban Glass Quarterly (Wichert, 1997, pp.14-21).

Figure 46 Hill, 1993, 'Jump' Non-lead kiln cast glass & raku fired ceramic glass, ceramic 51.1 x 28 x13.7 cm, Corning Museum of Glass Collection, Corning, NY

As previously discussed (see section 2.1), Jenny Mulcahy combines ceramics, bronze, glass and found objects in her work in a cold state (see Figure 47). She started to combine glass and ceramics in her work in 2001 as part of her practice based PhD, her work was published in the Australian journal *Ceramics: Art & Perception* (Naylor, 2007, pp.34-38).[39]

Figure 47 Mulcahy, 2006, 'Green Arch 2' Ceramics and kiln cast glass, 28 x 67 x 33cm

[39] For further information on Mulcahy see section 5.3.9.

A similar approach to Mulcahy (see Figure 47) is that of Margot Spuhler, who creates raku fired ceramics which she combines with cast glass elements, assembled in a cold state (see Figure 48). She started to combine both materials in the early 1990s, her work was featured in the German journal *Neue Keramik* (Spuhler, 1997, pp.526-527).

Figure 48 Sphuler, 1997, Raku fired ceramic & cast glass

Renowned ceramicist Kondo Takahiro has been combining cast glass and porcelain since studying at Edinburgh College of Art in 2002. His ceramics are complimented by thick blocks of glass which are assembled in a cold state (see Figure 49). Takahiro's glazes resemble dew, which draws links between the cast glass and the ceramic surface. His work has been widely published and was featured in the French journal the *Revue de le Ceramique et du verre* (Aoyama, 2005, pp.32-35).

Figure 49 Takahiro, 2007, 'Green Mist', Kiln cast glass & glazed porcelain

Closely aligned is the work of Etsuko Tashima who combines cast glass and ceramics in a cold state (see Figure 50). Her sculptures merge flower and animal, petal and bone to create subtly erotic compositions. She uses strong contrasts between glossy opaque surface of the glass and the matt and unglazed ceramic form. She started to work in both materials in 1992; her work was featured in the catalogue for the *Cool and Light New Spirit in Craft Making* exhibition (McCreery, 2004, p.4).

Figure 50 Tashima, 1996, 'Cornucopia', kiln cast Glass & stoneware

Andrea Walsh combines unglazed bone china paper clay and kiln cast glass to create unique vessels (see Figure 51). She fires her work together using fibre paper to separate the two surfaces to create an exact fit. The complementary elements are then assembled together in a cold state to create a flawless connection that appears to be one piece. She first started to combine both materials in 2002, her work was published in the UK journal Ceramic Review (Smith, 2008, pp.28-29).[40]

Figure 51 Walsh, 2008, Bone china vessels with cast glass disc

A similar approach to the work of Delsol (see Figure 40) is that of Nad Valleé who works in both cast glass and raku fired ceramics which she assembles in a cold state (see Figure 52). She plays with the lightness and density of the materials to intimate the unique visual language between the two materials.[41]

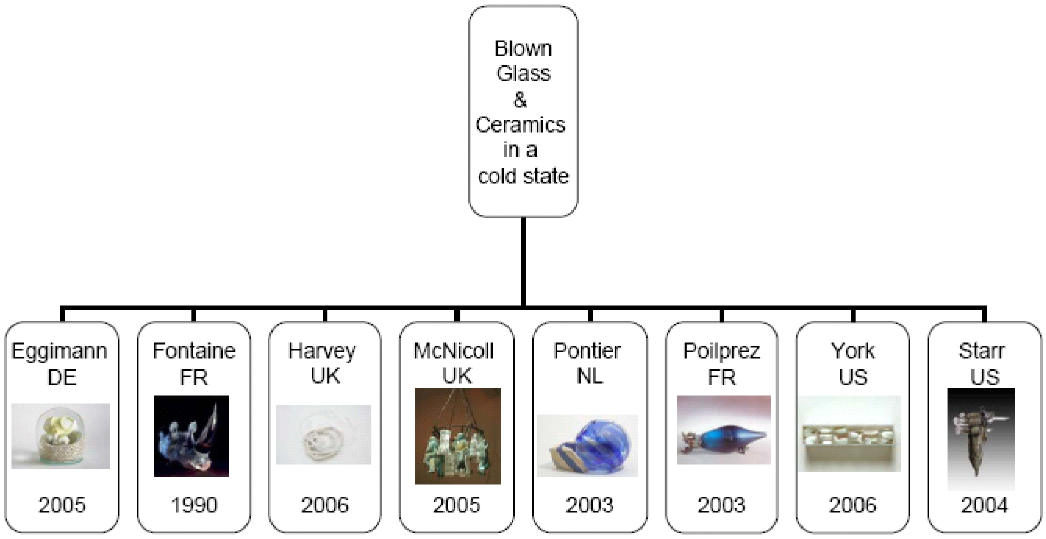
Figure 52 Valleé, 2000, 'Point Primal', cast glass & Raku fired ceramic, 40 x 16cm

2.3.3 Artists that combine hot glass with ceramics in a cold state

Eight artists demonstrate in some of their work the visual and practical attributes of combining ceramics and hot glass in a cold state: Eggimann, Fontaine, Harvey, McNicoll, Poliprez, Pontier, Starr and York; their work will be discussed in detail below.

[40] For further information on Walsh see section 5.3.16.
[41] For further information see (http://www.idverre.net/nadvallee), so far no published information has been found on Valleé.

Table 3 Visual Map of Artists that combine hot glass with ceramics in a cold state[42]



Marianne Eggimann creates porcelain animals, humans and landscapes which are encased in a cold state under a dome of blown glass (see Figure 53); the figures are enlarged by the water giving a strange focus to the surreal scenes. [43]

Figure 53 Eggimann, 2005, 'Fliege 1' Blown glass, distilled water & Limoges porcelain

A similar approach is that of Jean Fontaine who creates artworks that combine "living beings" and "machines". Fontaine's works are produced in stoneware ceramics and blown glass elements (see figure 54), which he combines in a cold state. He is one of the earliest examples found of an artist working in both hot glass and ceramics which he started to combine in 1990.Fontaine's work has been widely published and was featured in the French journal the *Revue de la Ceramique et du verre* (Frodievaux, 1996, pp.36-37).[44]

[42] The dates refer to when artists first started to work in both materials
[43] For further information on see (http://www.marianne-eggimann.com), so far no published information has been found on Eggimann.
[44] For further information on Fontaine see section 5.3.6.

Figure 54 Fontaine, 1995, ‘en verre et contre tout’ Stoneware ceramics & Blown glass.

Rebecca Harvey started to combine porcelain and blown glass in a cold state in 2006 (see Figure 55). She uses contrasts in texture and density of materials to reveal ‘unexpected harmonies’ or ‘delightful incongruities’ when the pieces are displayed together. [45]

Figure 55 Harvey, 2006, Slip cast porcelain & blown glass

In contrast, Carol McNicoll combines sculptural ceramic elements with found blown glass objects in a cold state (see Figure 56) to create her unique sculptural compositions. She started to work in both materials in 2004; her work has been widely published and was featured in the publication *Craft in Transition* (Veitberg, 2005, p.67).

Figure 56 McNicoll, 2005, ‘Hanging Shade’ Found glass objects and slip cast ceramics, brass frame, 40 x 40cm

[45] For further information see (http://www.rebeccaharvey .com), so far no published information has been found on Harvey.

Working mainly in blown glass, Isabelle Poliprez combines coloured glass forms with small elements of raku fired ceramics; which she assembles in a cold state (see Figure 57). The sculptural pieces are inspired by sea creatures, fish and other small animals. She started to work in both materials in the late 1990s, her work was featured in the French Journal the *Revue de la Ceramique et du Verre* (Greve, 2003, pp.24-26).

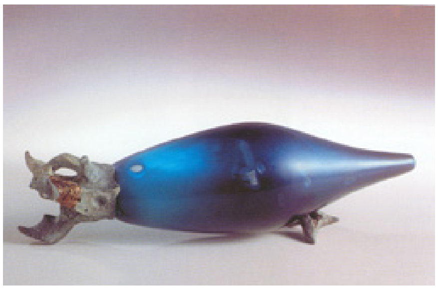


Figure 57 Poliprez, 2003, 'Untitled' Blown glass & raku

Mieke Pontier has been combining glass and ceramics since 1988. She started to combine stoneware with blown glass in a cold state in 2003 (see Figure 58) to create her one off sculptures which are inspired by nature.[46]

Figure 58 Pontier, 2003, 'Siberian Sky', Coloured stoneware & blown glass

Ron Starr is an American ceramic and glass artist; he uses glass as an extension of glazing on his stoneware sculptural vessels. He assembles his work in a cold state (see Figure 59) aligning the contrasting qualities of the two materials in one piece. He started to combine glass and ceramics in his work in 2004, his work was published in the monograph publication *Ron Starr* (Ullrich, 2004, pp.2-4).[47]

Figure 59 Starr, 2005, Skull, stoneware & blown glass

[46] For further information see (http://www.miekepontier.nl) so far no published information has been found on Pontier.
[47] For further information on Starr see section 5.3.14

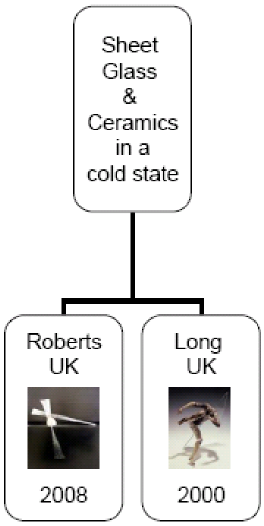
Julie York is an American artist, her mixed-media sculpture reflect her visual exploration of day-to-day experiences and her surrounding environment. Found objects are reproduced in slip- cast porcelain juxtaposed with metal, glass and plastic elements (see Figure 60), which she combines in a cold state. She first started to combine glass and ceramics in the late 1990’s. [48]

Figure 60 York, 2006, ‘Sweep’ Porcelain, Glass, Plexiglass, 15 x 4.5 x 4cm

2.3.4 Artists that combine sheet glass with ceramics in a cold state

Two artists demonstrate in some of their work the visual and practical attributes of combining ceramics and sheet glass in a cold state: Long and Roberts; their work will be discussed in detail below.

Table 4 Visual Map of Artists that combine sheet glass with ceramics in a cold state[49]



[48] For further information (http://www.perimetergallery.com/perimeter_gallery/ artistspages/york.html), so far no published information has been found on York.
[49] The dates refer to when artists first started to work in both materials

Mandy Long creates figurative ceramics in raku fired clay, which are then assembled within sheets of cut float glass in order to render her figures air borne (see Figure 61). Sometimes the glass is smashed to show the impact and aggression of contact with the figures; she started to combine glass and ceramics in the late 1990s.[50]

Figure 61 Long, 2000, Sheet glass & Raku fired Stoneware

A recent graduate of Plymouth School of Art, David Roberts uses multiple layers of float glass in his sculptures to reflect and refract light juxtaposed with ceramic elements (see Figure 62). He started to combine both materials in 2008, as part of his degree.[51]

Figure 62 Roberts, 2008, 'Experimental form' Linished, grogged raku clay body, float glass & UV glue, 65 x 65 x 10cm

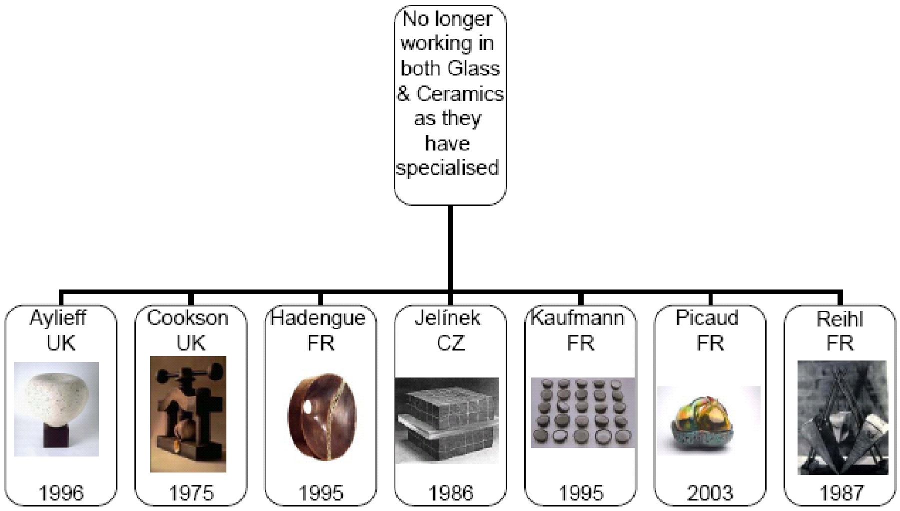
Long and Roberts both use sheet glass as a way of creating tension in their work creating a transparent barrier through which the ceramic must pass. The artist Oestreicher also uses this principle in some of her work, as previously discussed (see section 2.3.3)

2.3.5 Artists that are no longer combining glass and ceramics as they have specialised in one material

Seven artists were found that have previously combined glass and ceramics in their work, however they no longer do so as they have chosen to specialise in just one material: Aylieff, Cookson, Hadengue, Jelínek, Kaufmann, Picaud and Reihl; their work will be discussed in detail below.

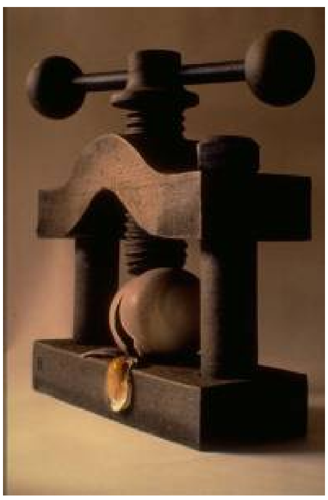
[50] For further information see (http://www. mandylong.com), so far no published information has been found on Long.
[51] For further information see section 5.3.11 or see (http://artandsoul-gallery.co.uk/ gallery/dave-roberts/thumbs.htm), so far no published information has been found on Roberts.

Table 5 Visual Map of Artists that are no longer combining glass and ceramics as they have specialised in one material[52]



As earlier discussed (see section 2.1), Felicity Aylieff has previously combined small pieces of glass and aggregates in her large scale ceramics (see Figure 63) which was developed as part of her MPhil research at the Royal College of Art. She carried on with this theme to create a body of artworks; she no longer uses glass in her work. Her work has been widely published and was featured in the publication *Naked Clay* (Perryman, 2004, pp.155-160).

Figure 63 Aylieff, 1995, 'Swollen Form', press moulded with porcelain aggregates & glass



Delan Cookson's early 'squeezed' forms were made from stoneware and melted glass which he combined in a cold state (see Figure 64). He started to combine glass and ceramics in his work in the 1970s. His current work is concerned with thrown porcelain vessels with crystalline blue glazes. His work has been widely published and was featured in the publication *Sculptural Ceramics* (Gregory, 1992, p.79).

Figure 64 Cookson, 1975, 'Egg Press', Stoneware & melted glass

[52] The dates refer to when artists first started to work in both materials

Christian Hadengue has previously worked in both glass and ceramics; to create his abstract ceramic sculptures. His early work had spaces within them for cut sheets of glass which he assembled in a cold state (see Figure 65); his ceramics are now combined with different materials such as bronze, wood or concrete. His work has been widely published and was featured in the French journal the *Revue de la Ceramique et du verre* (Moglia, 1995, p.55).

Figure 65 Hadengue, 1995, Raku Stoneware and sheet glass, 45 x 45cm

A similar approach is that of Ivan Jelínek who has also previously worked in both glass and ceramics, which he started to combine in the 1980s (see Figure 66), juxtaposing blocks of ceramic with sheets of glass in a cold state, He now works predominantly in glass and metal. His work was featured in the publication *Czech Glass* (Petrová, 2001, p.180).

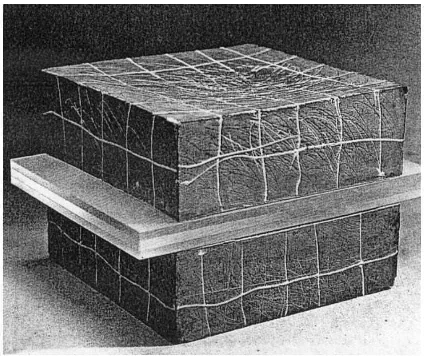


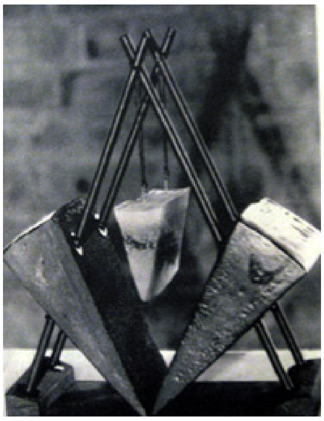
Figure 66 Jelínek, 1986, Stoneware & sheet glass

Jacques Kaufmann has previously worked in both glass and ceramics, fusing glass into ceramic vessels in a hot state (see Figure 67); he currently works only in ceramics. His work has been widely published and was featured in the French journal the *Revue de la Ceramique et du Verre* (Deblander, 1995, pp.19-25).

Figure 67 Kaufmann, 1995, 'Matrice', ceramic & cast glass

Fabienne Picaud works predominantly in glass, she often combines other materials in her works, she has previously combined ceramic in her work in a cold state (see Figure 68); she now combines metal with her glass. Her was featured in the French journal the *Revue de la Ceramique et du Verre* (Girard, 2000, p.47).

Figure 68 Picaud, 2003, 'Passage Ambre', Blown glass with a clay & electroplated copper base, 23 x 31cm



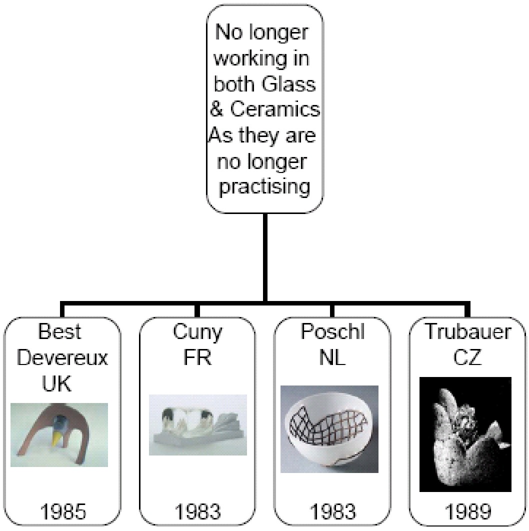
Pierre Reihl has previously created large scale assembled sculptures in dense ceramics balanced with elements of cast glass; which he assembled in a cold state (see Figure 69); he now works predominantly in ceramics. His work was featured in the French journal the *Revue de la Ceramique et du Verre* (Jacqué, 1988, p.54).

Figure 69 Reihl, 1987, Stoneware & cast glass, 38 x 36cm

2.3.6 Artists that are no longer combining glass and ceramics as they are no longer practising

A number of artists are no longer combining glass and ceramics as they are no longer practising. Four artists were found that did combine glass and ceramics in their work, they are however no longer practising as they have passed away: Best Devereux, Cuny, Pöschl and Trubaček; their work will be discussed in detail below.

Table 6 Visual Map of Artists that are no longer combining glass and ceramics as they are no longer practising[53]



Tatiana Best Devereux (1958 – 1993) combined kiln cast glass cores with her hand built ceramics, which she combined in a cold state (see Figure 70). She studied at the Rietveld Academy in the 1980s, her work was featured in the French journal the *Revue de la Ceramique et du Verre* (Girard, 1987, pp.45-47).

Figure 70 Best Devereux, 1985, 'Tripied'*, cast glass with slip cast earthenware, 25cm*

Veronika Pöschl (1950 - 2006) also studied at the Rietveld Academy, where she started to combine glass and porcelain in a cold state in 1981 (see Figure 71). She focused on hand built stoneware vessels for the majority of her career. Her work has been widely published and was featured in the publication *Glass a Contemporary Art* (Klein, 1989, p.167).

Figure 71 Pöschl, 1983, Vessel, blown glass & porcelain

[53] The dates refer to when artists first started to work in both materials

Jutta Cuny (1940 – 1983) combined porcelain with optical crystal in a cold state (see Figure 72).[54] She worked predominantly in just optical crystal which she carved by using deep sandblasting techniques. Her work has been widely published and was featured in the French journal the *Revue de la Ceramique et du Verre* (Nicola, 1983, p.103).

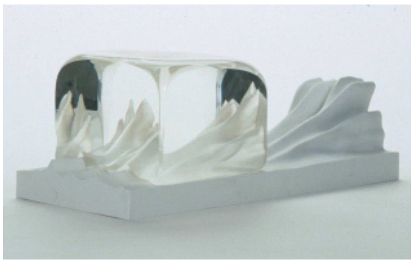


Figure 72 Cuny, 1983, 'Paysage Métaphysique' Sandblasted Optical Crystal & Sevres Porcelain 22 x 65 x 25cm, Collection of Musée des Arts décoratifs, Paris

Kroyštof Trubáček (1958 – 2000) worked mainly in ceramics, which he juxtaposed with small elements of blown glass, in a cold state (see Figure 73). He trained in the late 1970's in glass at VŠUP in Prague and in ceramics at ENSAD in Paris. His work was featured in the publication Czech Glass (Petrová, 2001, p.171).

Figure 73 Trubaček, 1989, 'Sea Pyramid', Blown Glass & Ceramics, 57cm

2.4 Summary of the Contextual Review

Throughout history, Glass and ceramics have been located within the same context in the following sectors: artistic practice, education and museum and galleries. In examining the combined histories of glass and ceramics it is evident that they are closely interwoven disciplines that have influenced each other for many years. A range of contemporary practitioners were reviewed, many artists choose to combine the materials in a cold state to avoid the known compatibility issues associated with the hot state combination of glass and ceramics. Artists that do work in a hot state have identified that the main disadvantage of combining glass and ceramics is the issue of incompatibility. They either live with the visual qualities of a cracked or flawed surface or work within the limitations of the materials on a small

[54] *Paysage Métaphysique* was realised at the Sevres Porcelain Manufactory and was finalised, from the original model, after Cuny's death.

scale to reduce the surface tension between the two materials. In the case of Binns, Groth, Lemaire and Thomas they have overcome compatibility issues by either developing a compatible clay body or by using an existing clay body that matches the expansion rate of their selected glass; an approach which has also been undertaken by this research project (see section 3.7).

The range of examples discussed shows that there is a strong relationship between the disciplines of glass and ceramics. Throughout this chapter it has been possible to examine links and crossovers between the two materials and to see practical issues and visual qualities that other artists have encountered and employed. In reviewing these reference points it has been possible to speculate on the origins and impetus of pioneering artistic practice. This research project can be seen as a benchmark and resource against which new works in glass and ceramics can be compared and contrasted to in the future. The study of the range of artists working in glass and ceramics has been extremely useful as it has allowed for a clearer understanding of the field to be elucidated; which has inspired and stimulated this research project. The Contextual Review suggests that this research project is relevant to the field of study and is a valid route of enquiry.

3. Material Testing

This Chapter discusses the material testing phase of this research project which relates to aims 1 and 2 and objectives 1 and 2 of the research. It gives an account of the material science and testing carried out in the field and it states the rationale for the testing. It covers the initial testing phase and its practical application. Followed by further testing that was carried out in terms of compatibility studies; the selection of a suitable clay body and the addition of quartz to these bodies to improve compatibility. Finally, it discusses the selection of an opaline glass to offset the visual aesthetic of the selected clay body.

3.1 Rationale for the Material testing

Glass and ceramics have many related material qualities and can be processed in similar ways. Chemically they are alike, however they are structurally very different; as ceramic is crystalline (composed of crystals) and glass is non-crystalline. This creates serious compatibility issues in terms of expansion and shrinkage rates when they are combined.[55] Through controlled processing, material properties can alter when each is partially converted into the other. It is recognised by artists in the field of studio ceramics that porcelain and bone china can partially convert into a glassy form when high fired to create a translucent material [56] (Rejinders, 2005, p.42). This is evident in the work of leading contemporary ceramicists such as Peter Lane, Angela Mellor and Sasha Wardell who exploit translucency in their work (Wardell, 2004). Likewise it is recognised in the field of industrial engineering that glass can partially convert into a ceramic form when processed in a controlled way to create a glass-ceramic material (Strnad, 1986, p.9). This is a controlled process of crystallisation and creates materials which have low or negative coefficient of expansion making them shock resistant and suitable for use in cookware, radomes, telescope mirrors and insulators. If not prepared with a controlled temperature schedule this

[55] The literature related to the material science of glass and ceramics was included in this chapter (not in the Contextual Review) in order to explicate relevant theories and definitions as they arose.
[56] If the wall is sufficiently thin enough.

process is known as devitrification which creates an unstable form of glass-ceramics, with visible cracks and stresses (Bray, 2000, pp.106-107). There appears to be no evidence of this process being used by studio practitioners; as discussed below by Bray (2000, pp.109-110):

> *A great deal of research is being carried out into the considerable possibilities and potential of glass ceramics but as yet there is little sign of them being exploited in a studio…. Many glass ceramics also require rather high melting conditions and more accurate controls than are likely to be found in the small studio or workshop.*

There is little evidence of glass-ceramic materials or processes being exploited by studio practitioners. From the outset it became apparent that the study would be directed by the capabilities of the studio practitioner within a studio environment. It was therefore decided that the production of glass-ceramics was outside of the parameters of this research. This was due to the specialist material science equipment needed to facilitate such an enquiry; the high temperatures and controls required to create glass-ceramics are beyond the provision of a studio environment.

It was agreed that this research project should be approached using viable studio materials and processing techniques only. The clay body was set as the variable and given the known translucency and glassy phases present in porcelain and bone china; these bodies were selected. *Philips* furnace studio glass was taken as the constant blown glass to be used with the *Gaffer* blowing rods and powdered frits (which are used to colour the *Philips* Furnace) widely used by glass artists and hot glass studios. Additionally, the *Gaffer* casting glass billets and frit were taken as the constant casting glass commonly used by kiln casting glass artists. The rationale for the initial testing phase was to identify key studio processing techniques which combined glass and ceramics in a hot state, which could be readily applied by studio practitioners in the field. These process routes were then tested in order to demonstrate and address the compatibility issues associated with the combination of glass and ceramics within studio practice.

A range of existing clay bodies were identified and those which matched (as closely as possible) the expansion rate of the studio glass were selected. These clay bodies were then altered by adding quartz to enhance and improve the compatibility of the materials. These clay bodies were then tested using the viable hot state processing routes in order to demonstrate how the compatibility issues had been addressed. The objective of the testing phase was to create in a hot state combined glass and ceramic tests which retain a compatible coherent whole without excessive cracks or stresses. This was viewed as an acceptable criterion for a successful test, in line with the primary objective of the research.

Practical tests were undertaken to locate viable hot state processing routes which combine glass and ceramics in studio practice. Generally, testing was planned before the practical work commenced, however other tests were conducted in response to results gained and to test potential ideas for artworks. The tests were considered from the practical aspects of stability and the visual quality of the pre-fired, biscuit and post-fired stages. The specific details of each test are contained within the *Materials Testing Phase Tables* (see Appendix 6) and the *Materials Testing Phase Sheets* (see Appendix 7); additionally the general materials used are detailed (see Appendix 8).

3.2 Material testing Phase 1

A series of tests were conducted at an early stage in order to locate creative parameters and provide a clearer starting point against which future tests could be compared, contrasted and improved upon. The main problem identified was compatibility in the structural differences of glass and ceramics. This is directly related to the varying co-efficient of expansion of the materials, associated with the difficulties of controlling the process of partially converting either material into the other without creating instability i.e. excessive cracks or stresses. If improved results could not be obtained these initial tests would have confirmed that the difficulty of creating a balanced stable system of glass and ceramics that avoids incompatibility (in terms of excessive cracks and stresses) was not possible.

This would have made the process routes unacceptable for studio practitioners. However, the fact that the combination of glass and ceramics was shown to be possible in principle, in terms of the chemical similarities of the materials; (despite severe visual and structural anomalies) this provided an important progression for this research project. In order to progress the research further, related studio routes and standardised tests were investigated in order to improve upon the practicality, stability and visual results of combining glass and ceramics in a hot state.

3.3 Process Variables

Specific process variables were set out to ensure standardised tests were achieved, five process variables were identified:

Variable 1: Proportion of glass and ceramics

Variable 2: Addition of other materials

Variable 3: Processing temperatures

Variable 4: Ceramic bodies

Variable 5: Design in terms of scale and form

3.3.1 Process Variable 1: Proportion of glass and ceramics

The use of varied proportions of glass and ceramics to control the mix of the materials was important. It was assumed that the ratio of glass to ceramic would have a distinct effect on the combination of the materials and consequently the quality of the final test. Therefore, the development of an optimum mixing ratio was an important consideration.

3.3.2 **Process Variable 2:** Addition of other materials

It was assumed that the addition of burn out materials such as paper pulp and fillers of grog and quartz silica sand would open up and strengthen the clay body. It is known that shrinkage occurs as the ceramic material dries and as it is fired. The addition of other materials to control the combined mix of glass and ceramics was also an important consideration.

3.3.3 **Process Variable 3:** Processing temperatures

Various processing temperatures were tested to control the firing and to identify an optimum firing temperature. Porcelain is usually fired between 1280°C - 1300°C and is the highest firing body; Bone China is usually bisque fired to 1250°C and then glaze fired to 1080°C. All of the ceramic temperatures go much higher than the usual firing temperatures for glass which range from 700°C – 850°C. The firing temperatures would have a substantial effect on the durability and the final fired quality of the test.

3.3.4 **Process Variable 4:** Varied ceramic bodies

Various ceramic bodies with different expansion rates were tested to measure the thermal behaviour of the materials. A search to find a clay body that would closely match the thermal contraction rate of the glass was conducted (see section 3.6).

3.3.5 **Process Variable 5:** Design in terms of scale and form

Various designs (in terms of scale and form) were used to control the behaviour of the materials when high fired. This variable is closely related to the above variables, as the design of the work determines how the combined materials expand, contract and flow when fired. It was necessary to develop different forms in order to create a balanced (streamlined) design that avoids excessive stresses caused by restrictive or unbalanced thermal expansion locating an optimum form for testing.

3.4 Process Routes

A substantial part of the research methodology has been focused on creative practice and the production of Artworks (see Chapter 4) which were developed alongside systematic material testing as described in this chapter. Four potential routes were identified, which were within the scope and experience of the researcher's previous studio practice. These routes were used to inform the making of related artworks. The following four potential process routes were selected and explored using the process variables, to map the creative parameters of combining glass and ceramics in a hot state:

Process Route 1: The combination of (green state) ceramics with glass frit

Process Route 2: The combination of a ceramic setter with glass frit

Process Route 3: The combination of kiln cast glass with ceramic

Process Route 4: The combination of a ceramic core with hot glass

From the outset it was decided that the criterion for a stable test and process would be the production of an even surface, without excessive cracks or stresses. The materials to be initially tested were a Special Porcelain from *Valentines* and a furnace Glass from *Philips*. This porcelain was selected, as a white clay body was required to achieve the desired visual aesthetic and because of its known partial conversion into a glassy, translucent state when high fired. The Philips furnace glass was the studio standard and is readily available to studio practitioners in the UK.

3.4.1 Process Route 1: The combination of (green state) ceramics with glass frit

Glass frit was prepared in the hot glass studio using a hot fritting technique, by slowly pouring trails of hot glass directly from the furnace into cold water. Varying degrees of this glass frit were then mixed with slip cast and solid, hand built porcelain at the wet green stage and formed into square test tiles (see Figure 74). The tests were then biscuit fired to 1000°C and high fired to 1280°C.

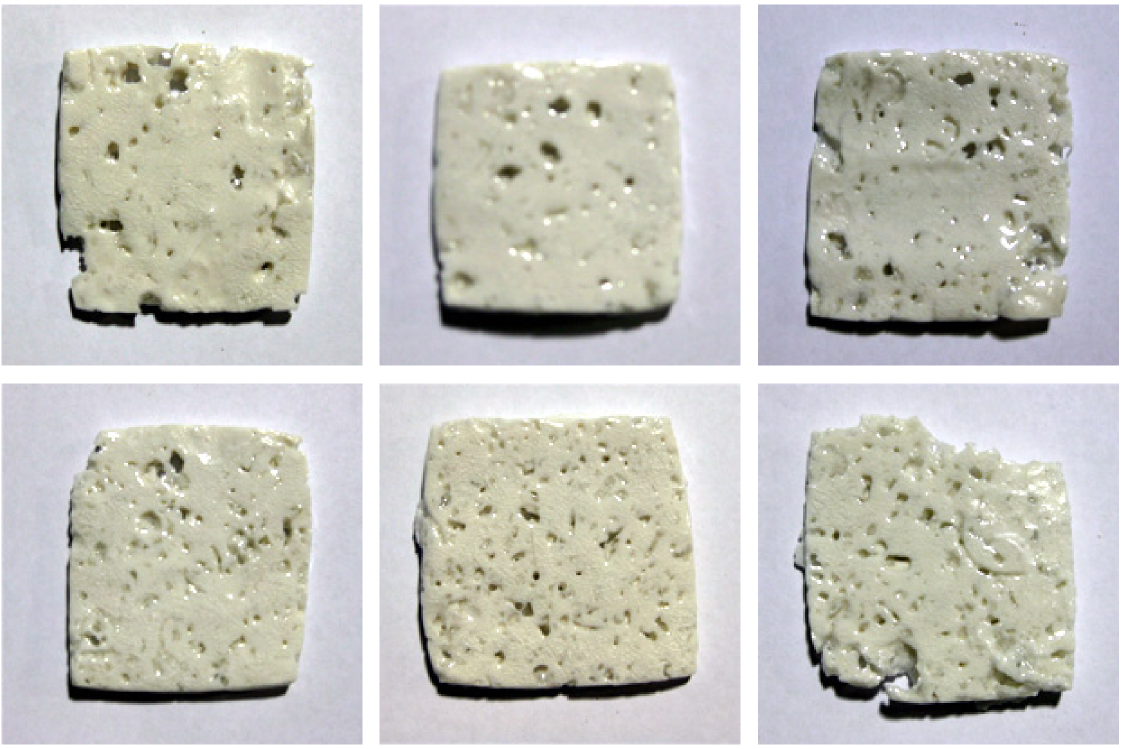


Figure 74 Kelly, 2005, Route 1 Test 1Ai – 1Avi (clockwise), Porcelain & glass frit, 4 x 4cm

At the green state it was far easier to combine glass frit to slip as this could be mixed without using the hands[57]. At the biscuit stage the glass bonded, but did not melt as it was possible to see the original form of the glass. Small surface tension stresses and cracks were visible at this stage. When high fired the tests retained the original form as a whole, however on closer inspection it appeared that the glass had melted and embodied the ceramic (see Figure 75).

[57] When frit is mixed by hand with soft clay it can cause small particles to enter and cut the hands.

It was observed that the glass had formed an interface layer with small cracks and stresses apparent in the surface as well as melting through the porcelain surface. The apparent visible pits and *crackle* effect demonstrated that the system was unbalanced and was not a stable test (see Materials Testing Sheet 1A, Appendix 5).

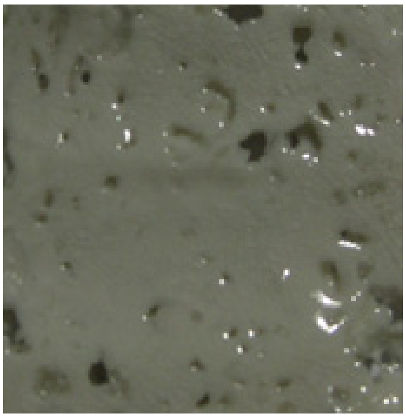


Figure 75 *Kelly, 2005, Detail of Route 1 Test 1Aiii, Porcelain & glass frit*

3.4.2 Process Route 2: The combination of a (high fired) ceramic setter with glass

Slip cast porcelain was cast into square test tiles, which were diamond cut at the biscuit stage with an inlay that would act as a vessel for the glass frit to sit within. Glass frit was prepared in the hot glass studio using a hot fritting technique; the frit was then set into the inlay of the pre-fired ceramic and high fired to 1260°C (see Figure 76).

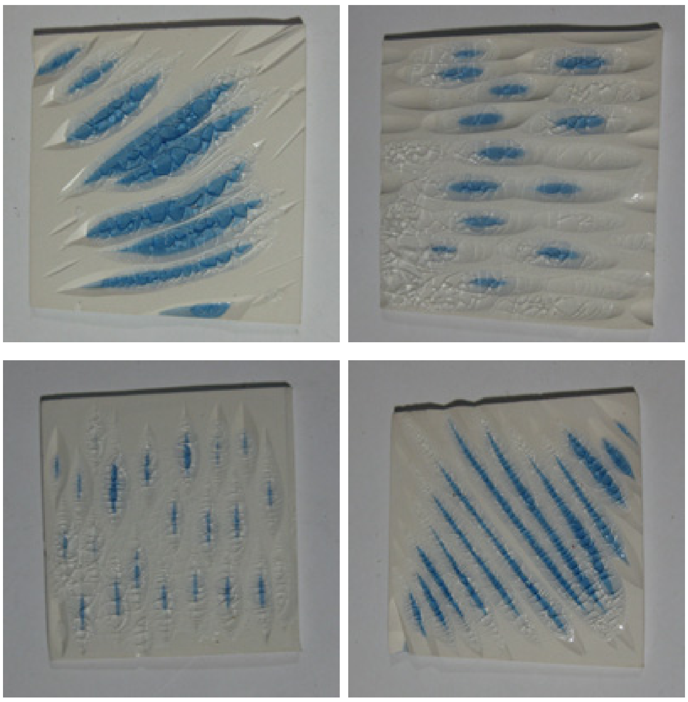


Figure 76 Kelly, 2005, Route 2A Test 2Ai – 1Aiv (clockwise), Porcelain & glass frit

Upon firing the test retained its form as a whole, however on closer inspection small cracks and stresses were visible (see Figure 77). The surface cracking that occurred in the glassy surface was due to the incompatibility of glass and ceramics. These visible defects demonstrated that the system was unstable and not balanced and was therefore not an acceptable process.

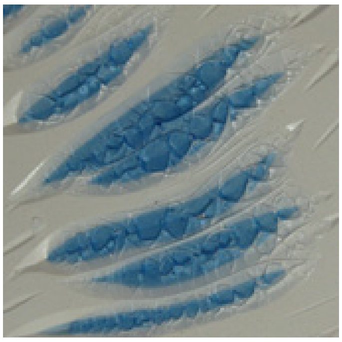


Figure 77 Kelly, 2005, Detail Route 2 Test 2Aii, Porcelain & glass frit, 10x10cm

A stalactite form, a slice form and a trailed form were also made and tested in the same way (see Materials Testing Sheets 2A - 2E, Appendix 5). This *crackle* effect was used in some of the early stage emerging artworks (see section 4.3); to demonstrate the compatibility issues that were apparent in the early stages of this research project.

3.4.3 Process Route 3: The combination of kiln cast glass and (high fired) ceramic

Glass frit was prepared in the hot glass studio using a hot fritting technique. This frit was then mixed with bisque and high fired porcelain aggregate and packed into egg; disc and boat shaped moulds and fired to 750 °C.

Figure 78 Kelly, 2005, Route 3 Test 3Ai, 3Bi, 3Bii & 3Ci (clockwise), Porcelain aggregate & glass frit

This firing created a melted interface that was bonded. It became apparent that it was important to use larger pieces of porcelain aggregate, if smaller pieces were used it dissolved completely in the glass as it was too fine. When fired the tests retained their forms as a whole however on closer inspection significant cracks and stresses were apparent, especially in Test 3Ci (see Figure 79). The surface cracking that occurred in the glass and

ceramic surface was due to incompatibility in the materials. These visible defects demonstrated that the system was unbalanced and was therefore not a stable test (see Materials Testing Sheet 3A, 3B & 3C, Appendix 5).

Figure 79 *Kelly,2005, Route 3 3Ci (detail), Porcelain aggregate & glass frit*

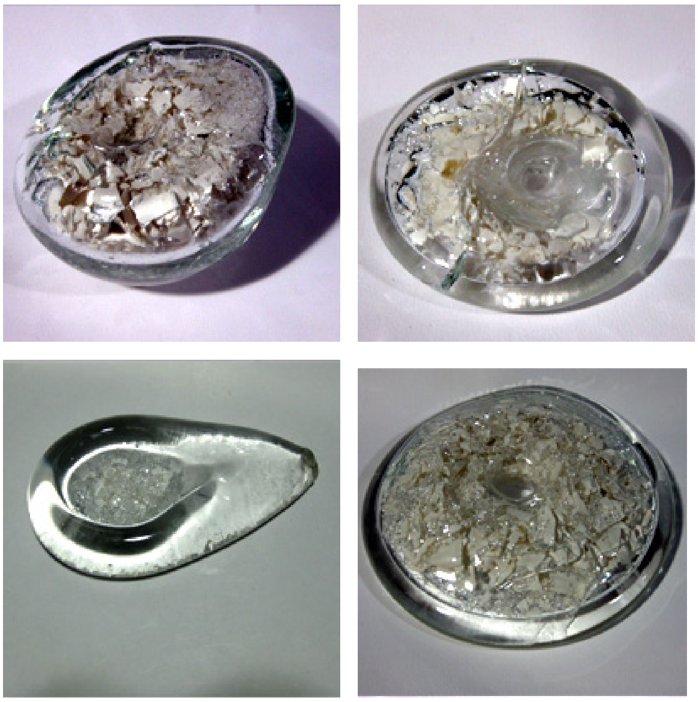


Figure 80 Kelly,2005, Route 3 Test 3Di, 3Dii, 3Diii & 3Ei (clockwise), Porcelain aggregate & glass frit set into pre blown glass form

Additional tests were carried out which related to the *Emergence* series of artworks (see section 4.9 & 4.10), the prepared glass frit was mixed with high fired porcelain aggregate and packed into 3 pre-blown disc forms and a pre-blown glass ring and fired to 750 °C, soaked for 30 minutes and annealed (see figure 77). When fired the tests retained their forms as a whole, however, on closer inspection small cracks and stresses were apparent. The surface cracking that occurred in the glass surface was due to incompatibility (see Figure 81). These visible defects demonstrated that the system was unbalanced and was not a stable series of tests (see Materials Testing Sheet 3D & 3E, Appendix 5).

Figure 81 Kelly, 2005, Detail Route 3 Test 3Dii, Porcelain aggregate & glass frit set into pre blown glass form

3.4.4 Process Route 4: The combination of a (high fired) ceramic core with hot glass

A porcelain core was heated up in a pick up kiln to 750°C and then picked up with a small punty of hot glass from the furnace. The ceramic core was then encapsulated with a prepared bubble of hot glass which was pushed over the core, cracked off, reheated and completely sealed (see Figure 82).

Figure 82 Kelly, 2005, Route 4 Test 4Ai (left) & 4Aii (right), Porcelain core & hot glass

During the annealing process, severe stresses and cracks occurred due to incompatibility in the materials (see Figure 83). These visible defects demonstrated that the system was unbalanced and was therefore not a stable test (see Materials Testing Sheet 4A, Appendix 5). Three more tests were conducted using this route, see below.

Figure 83 Kelly, 2005, Detail, Route 4 Test 4Aii, Porcelain core & hot glass

Figure 84 Kelly, 2005, Route 4 Test 4Bi, Porcelain core & hot glass

Firstly, fine trails of glass were gathered from the furnace and trailed around a high fired porcelain core. During the annealing process the glass cracked the ceramic core completely in half, possibly due to an intense thermal shock (see Figure 84).

The glass trails remained adhered to the surface, in small droplets that formed as if the ceramic had repelled the glass (see Figure 85). This was a partly successful test as the glass and ceramic remained in surface contact and did not cause either surface to crack, however, the form did break into two parts (see Materials Testing Sheet 4B, Appendix 5).

Figure 85 Kelly, 2005, Route 4 Test 4Bi Detail, Porcelain core & hot glass

Secondly, porcelain was mixed with glass frit in a 1:1 ratio in the green state and formed into small discs and high fired. These discs were heated up to 750°C and then picked up directly from the pick up kiln with a small punty of glass and encapsulated in a gather of hot glass (see Figure 86).

Figure 86 Kelly, 2005, Route 4 Test 4Ci (left) & 4Cii (right), Porcelain discs & hot glass

During the annealing process severe stresses and cracks occurred due to the incompatibility of glass and ceramics (see Figure 87). These visible defects demonstrated that the system was unstable and was therefore not an acceptable test. However, the cracks were less fractious in comparison to the larger core and the overall form remained intact. This indicated that the size of the ceramic inclusions have a direct effect on the cracking of the glass; which means that scale would affect the outcome of a successful test piece (see Materials Testing Sheet 4C, Appendix 5).

Figure 87 Kelly, 2005, Detail Route 4 Test 4Cii, glass

Thirdly, high fired porcelain trails were heated up to 750°C and then picked up directly from the pick up kiln. They were then laid into a rectangular area of moist casting sand. A large hot pour of glass was gathered in a ladle and poured over this area; the glass was then allowed to cool and placed into the annealing kiln (see Figure 88).

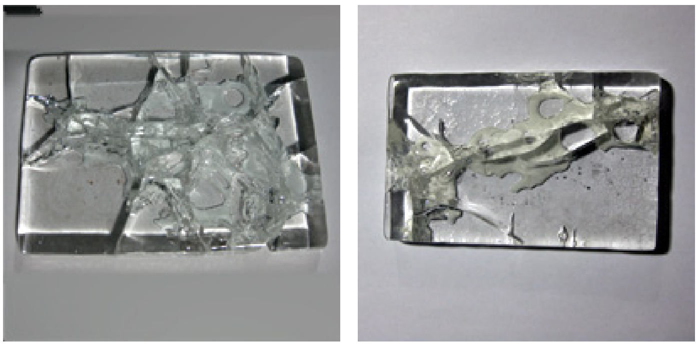


Figure 88 Kelly, 2005, Route 4 Test 4Di (left) & 4Dii (right), Porcelain trails & hot glass

During the annealing process, severe stresses and cracks occurred due to the incompatibility of the materials (see Figure 89). These visible defects demonstrated that the system was unstable and was not an acceptable test (See Materials Testing Sheet 4D, Appendix 5).

Figure 89 Kelly, 2005, Detail Route 4 Test 4Di, Porcelain trails & hot glass

Finally, in order to test out an idea for an artwork, high fired porcelain chips were heated up to 750°C and then picked up directly from the pick up kiln. They were then laid into a pre-formed area of moist casting sand. A large hot pour of glass was gathered in a ladle and poured over this area; the glass was allowed to cool and then placed into the annealing kiln (see Figure 90).

Figure 90 Kelly, 2005, Route 4 Test 4Ei), Porcelain aggregate & hot glass

During the annealing process, severe stresses and cracks occurred due to the incompatibility of the materials (see Figure 91). These visible defects demonstrated that the system was unstable and was not an acceptable test (see Materials Testing Sheet 4E, Appendix 5).

Figure 91 Kelly, 2005, Route 4 Test 4Ei Detail, Porcelain aggregate & hot glass

Through the initial testing of the four process routes, it became apparent that the research required compatibility studies to be introduced in order to understand the differences in expansion rates between the ceramics and glass. Taking into account the surface stresses and cracks that were occurring in the glassy surface, it was construed that the ceramic would need to be altered in order to match the thermal expansion of the glass. The glass would therefore remain as the constant and the ceramic would be the variable. A suitable clay body needed to be either found or formulated; these observations led the research to the second phase of material testing which was concerned with compatibility studies to improve the practical application of the initial material testing.

3.5 Material Testing Phase 2: Compatibility Studies

As part of this Material Testing Phase, compatibility studies were developed in order to analyse the thermal expansion behaviour of the materials to improve the tests and subsequent artworks. Incompatibility shows up as small cracks or stress lines when types of incompatible glass and ceramics are fused together. These cracks will increase with time and may result in a complete separation. Incompatibility that shows up as small cracks is not a problem because it is obvious that the test cannot be used. Incompatibility problems that are not visible to the naked eye need to be determined through compatibility testing. Incompatibility is common in relation to ceramics, glazes and glass due to the creation of stress in the making process. Incompatibility is usually seen in ceramics when expansion rate defects (related to silica inversion) causes shrinkage or when a glaze does not fit the body which causes peeling or crazing effects, due to different contraction rates. Incompatibility is seen in glass if coloured glasses of different expansion are fused together. Poor firing schedules can also have an effect on both glass and ceramics which is caused by differential cooling, when heat travels through the materials at different rates, stress can be created; in glass prolonged annealing programmes are used to resolve this (Bray, 2000, p.146).

In total, six compatibility tests were reviewed in order to decide which would be the most appropriate test to measure expansion behaviour of a combined system of glass and ceramics (see Appendix 4). It was decided that the ‘Polarized lens’ test would be the most appropriate method to view stress in the tests that were transparent and that the ‘Bow’ test and ‘Strain Energy’ test would be the most appropriate way of measuring stress in the opaque tests. It was however decided to concentrate on accurately matching a ceramic body that could be encapsulated between two layers of hot glass first; if this was achieved it could be assumed that all other tests with these materials would be compatible.

3.6 The Selection of a suitable clay body

A starting point for this second phase of material testing was to discover which clay body would be compatible with the *Philips* Furnace glass and the *Gaffer* blowing and casting glass, when mixed in a hot state. The selection of a compatible clay body which was accommodating and tolerant was essential to the success of this research project. If a suitable body was not found it would have been necessary to create a new body that was tailored to the research requirements i.e. a compatible ceramic body that will accommodate a glass, within a 10% difference of expansion. This would have been a difficult process and would have pushed this study beyond its time frame. This along with other possible future process routes will be discussed further in the conclusion (see Chapter 6).

Firstly, the four main types of porcelain were considered (Bray, 2000, pp.40 - 45), as follows:

1. Hard Paste Porcelain: can be high fired from 1280°C to 1300°C or even up to 1400°C. It is a hybrid of hard and soft paste characteristics. It increases quality and provides reliable reproduction results. It is usually made up of 50% kaolin or china clay and balanced equal parts of potassium feldspar and quartz.
2. Soft Paste/ pâte tendre porcelain: can be fired relatively low to 1240°C. It fires to a bright luminous white; however it lacks durability, resonance and the tactility of hard paste it also has a tendency to collapse. It is usually made up of 50% kaolin or china clay and balanced equal parts of nepheline syenite and quartz.
3. Bone China: can be fired to 1250 °C at Bisque and then glaze fired at a lower temperature to 1080 °C. It is usually made up of 50% Bone ash and balanced equal parts of china clay and feldspar.
4. Parian: is a white statuary material; which can be sharply defined for sculptural moulding. It is a porcelain body to which ground bone china and feldspar are usually added to create a soft paste, unglazed body which does not require glazing due to its glassy fired surface.

An enquiry into existing commercial clay bodies from *Valentines, Scarva, Potclays* and *Pottery Crafts*[58] identified 19 clay bodies that would be suitable for further testing (see Appendix 7). This was progressed further by a series of testing, which examined the strength, expansion behaviour, fired colour and firing range of the clay bodies when combined with glass (see Materials Testing Sheets 1C & 2C & 2J, Appendix 5). This selection process eliminated bodies, which were not compatible with the glass. The close examination of the selected clay bodies, led to the focused testing of the potential clay bodies. Further studies were carried out to find out the best handling and firing ranges of the clays when combined with glass. It was observed that open bodied clays with the additions of grogs or cellulose fibres are less likely to shrink and are strengthened. The added grog and aggregate can reduce or eliminate warpage, distortion and cracking at drying

[58] National distributors of various clay bodies.

and firing stages (Hutchinson–Cuff, 1996, p.121). Cellulose fibres improve working strength, cohesion, drying crack resistance and dry strength and quartz increases the expansion rate of the body (Reijinders, 2005, pp.30-39). It was important to eliminate clays which demonstrated excessive shrinkage to prevent incompatibility, warpage, distortion and cracking at the drying and firing stages. The maturing and vitrification points were also important factors to consider in the selection process of a potential clay body. Bray (1995, p.28) discusses below the coefficient expansion rates of different materials:

> *Most materials expand or contract when heated or cooled. The amount of change is expressed as a coefficient of expansion and refers to the change in length per unit of a material as its temperature changes by one degree centigrade. Every glass has its own coefficient of expansion. Some, such as the borosilicates, tend to have low expansion whilst the common soda-lime-silica glass tends to have a high expansion.*

Bray also provides a table which gives the approximate thermal expansion rates of a range of materials for purposes of comparison, some of which has been recreated below with the addition in bold of the materials used in this research study: *Gaffer* casting and blowing glass, *Philips* Furnace glass, *Valentines* Porcelain and *Pottery Crafts* bone china (see Table 7).

Table 7 (Bray 1995) Thermal Expansion coefficients of a range of glass and ceramics

Material	Temp. range(°C)	Coefficient ($x10^{-7}$)	Coefficient ($x10^{-6}$)
Silica Glass (Fused silica/Quartz)	0-1000	5	0.5
Borosilicate glass (Pyrex)	0-600	32	3.2
Soda-lime-silica glass	0-500	90	9
Porcelain	0-1000	60	6
***Valentines* Porcelain**	**0-500**	**69**	**6.9**
***Pottery Crafts* Bone China**	**0-500**	**85.4**	**8.54**
***Philips 3300* Furnace Glass**	**0-300**	**96**	**9.6**
***Gaffer* Blowing Glass Rods**	**0-300**	**96**	**9.6**
***Gaffer* Casting Glass Billets**	**0-300**	**92**	**9.2**

Additionally, data on the expansion rates of the materials used in this research study have been provided (see Appendix 8). This helped with the comparison of the different clay bodies with the Philips and Gaffer glass.

From this initial analysis it became apparent that the *Pottery Crafts* bone china (85.4 x 10^{-7}) was closest to the *Philips* furnace glass (96 x 10^{-7}) and the *Gaffer* blowing (96 x 10^{-7}) and the *Gaffer* casting glass (92 x10^{-7}) expansion rates, almost to a 10% difference, which as a rule of thumb would mean that they are close enough to fit in terms of compatibility.[59]

3.7 The use of Bone China as the closest compatible existing clay body

Bone china is usually high fired to 1250 °C and then glaze fired at a lower temperature of 1080 °C. More volatile than other bodies when fired, bone china is more likely to warp or move in the firing. The design at this point therefore proved to be essential when using this material either as a streamlined form that avoids distortion or as an organic visual qualities that encourages movement in the form when fired. Bone china fits the required visual aesthetic better than the other bodies tested due to the firing range, body colour and resultant translucency. Bone china is also more suitable when used as a setter as it can be high fired at bisque and then low fired at the second firing when the glass is added to the surface. However, in some cases an initial bisque firing phase had to be added for refinement processing to take place, as a high-fired piece would be too hard to diamond cut.

The *Pottery Crafts* bone china body was selected for testing, as was the *Valentines* porcelain body as an alternative to draw comparisons against. Tests were conducted on these bodies by encapsulating high fired porcelain and bone china test within 2 layers of hot poured *Philips* glass, both cracked after the annealing cycle. It was decided that quartz silica sand needed to be added to these bodies in order to improve the compatibility of the materials and increase the expansion rate of the ceramic to match the glass (see section 3.8).

[59] This was calculated with external advisor Dr Doug Crozier.

3.8 The addition of quartz to improve the compatibility of the clay bodies to glass

In order to improve the compatibility of the selected clay bodies with glass, a series of tests were planned which varied the amount of quartz to be added to the clay bodies. Quartz silica sand is a glass former commonly used in porcelain, it has a very high melting point (around 1710^{o}C) so it must be used with a flux.[60] If too much quartz is present, the porcelain may crack, whereas too little may lead to crazing problems in glazes (Wardell, 2004, p.14). The presence of quartz and cristobalite can increase the expansion rate of a clay body during firing which can cause tension build up within thick or large scale pieces. Usually practitioners try to control and reduce the amount of quartz and cristobalite to avoid this. The addition of quartz to the ceramic body can be added to intentionally increase the expansion rate of the body to match the rate of the glass, as discussed below by Reijinders (2005, pp.30-31):

> *Quartz and sometimes whiting, wollastonite or large amounts of talc are added to an earthenware clay body intended to be used for functional ware (also bathroom tiles) in order to increase the expansion rate of the body intentionally. These encourage a good glaze fit: a balancing out of the expansion rate between glaze and body reducing the chance of crazing. Molochite is added to a clay body to reduce the expansion rate.*

In light of this it was decided to test if quartz could be added intentionally to increase the expansion rate of the clay body to match the rate of the glass. Varying amounts of quartz were added to the porcelain and bone china bodies in the green slip state; these were then high fired and then encapsulated within layers of hot poured glass (see Figure 92).

Figure 92 Kelly, 2009, Route 4 Test 4Fi Bone China (left) & 4Fii Porcelain (right) with quartz & glass frit

[60] Fluxes lower the melting point of silica, usually in the form of potash feldspar.

An optimum quantity of quartz was identified and after the annealing cycle several samples came out in one piece without any visible signs of stress or strain. The tests were placed under a *polarimeter* to view any stress that may be present (see Figure 93).

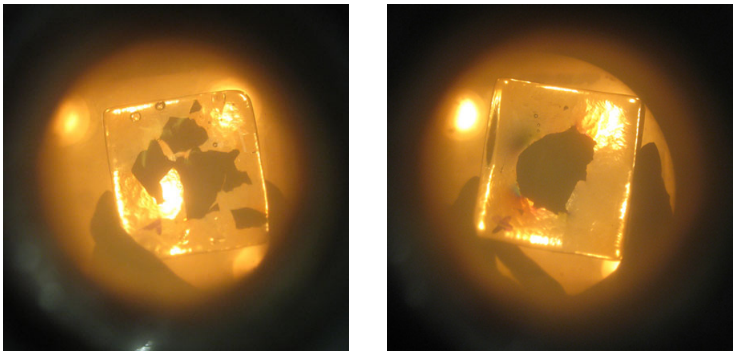


Figure 93 Kelly, 2009, Test under Polarimeter Route 4 Test 4Fi Bone China (left) & Test 4Fii Porcelain (right), with quartz & glass frit

These tests revealed that the Bone china test 4Fi (above left) had no stress and that the porcelain test 4Fii (above right) did have stress, which is revealed by the pink/red spectrums in the sides of the test (see Materials Testing Sheet 4F, Appendix 5).

Issues relating to shrinkage were considered and to find an optimum temperature that avoids firing the combined body too high which would lead to possible distortion of the form. Filler materials such as quartz, as previously discussed are commonly added to a clay body. However, quartz increases the expansion rate of the ceramic which weakens the body making it unsuitable to make sculptures with and should not be used to make large tiles and complex pieces (Reijinders, 2005, pp.36-37). This implies that bodies with the addition of quartz will not be suitable for working with complex sculptural pieces. This was an important factor to consider as this could rule out certain designs and forms and may inhibit the creative process. Further tests with burn out paper pulp to improve the clay structure were therefore carried out to try and improve the materials strength.

3.9 Process routes with Bone China & Porcelain clay bodies with quartz addition

The bone china and porcelain body with added quartz was applied to all four potential process routes to test the practicality of these revised clay bodies.

3.9.1 Process Route 1: The combination of (green state) ceramics with glass frit

The *Philips* glass frit was prepared in the hot glass studio using a hot fritting technique. The glass frit was then mixed with the prepared bone china slip and quartz (in varying proportions) and the porcelain slip and quartz (in varying proportions) at the wet green stage and formed into round test tiles. The tests were then bisque fired and diamond cut and then high fired to 1250°C (see Figure 94). Surface tension stresses and cracks were visible which demonstrated that the system was unbalanced and was not a stable test. To achieve compatibility the tests would need to be fired at around 750°C to anneal the glass; however this second firing would cause the glass to become devitrified and cloudy which would not be suitable; this process route was therefore unsuitable and was therefore discounted at this stage (see Materials Testing Sheet 1B, Appendix 5).

Figure 94 Kelly (2008) Route 1 Test 1Ci-1Cii Bone China & 1Ciii & 1Civ Porcelain with quartz & glass frit (clockwise)

3.9.2 Process Route 2: The combination of a ceramic setter with glass frit

The Bone china and Porcelain clay bodies were mixed with added quartz (in varying proportions) which were then slip cast into round test tiles. The tiles were bisque fired and diamond cut and then high fired to 1250 °C. *Philips* glass frit was prepared in the hot glass studio using a hot fritting technique. This frit was then set onto the test tiles and fired to 700 °C, soaked for 30 minutes and annealed on a glass programme (see Figure 95). Upon firing the tests retained their form as a whole, it was possible to see that the test 2Fi the bone china body with the highest proportion of quartz added (100g quartz: 100ml of slip) was the most compatible. No cracks and stresses were apparent, this demonstrated that the system was stable and balanced and was compatible and therefore an acceptable test (see Materials Testing Sheet 2F, Appendix 5).

Figure 95 Kelly, 2008, Route 2 Test 2Fi-2Fii Bone China & 2Fiii & 2Fiv Porcelain with quartz & glass frit (clockwise)

3.9.3 Process Route 3: The combination of kiln cast glass with (high fired) ceramic aggregate

Philips glass frit was prepared in the hot glass studio using a hot fritting technique and pre-prepared *Gaffer* casting frit was used. The bone china and Porcelain clay bodies were prepared with the quartz mix in a 1:1 ratio (500g of quartz to 500ml of slip). This was then slip cast using paper pulp forms (egg boxes), high fired and then crushed into aggregate chips. This was then mixed with the glass frit and packed into an egg shaped mould and fired to around 890°C, soaked for 4 hours and 30 minutes and annealed (see Figure 96). When fired the tests retained their form as a whole; no visible cracks and stresses were apparent in the bone china tests which demonstrated that the system was balanced and was therefore a stable test; which was confirmed as compatible when viewed under the *Polarimeter* as no stress could be detected. The porcelain tests however did have visible stresses and was therefore an incompatible series of tests (see Materials Testing Sheet 3I, Appendix 5).

Figure 96 Kelly, 2009, Route 3 Test 3Ii-3Iii Bone China & 3Iiii-3Ivi Porcelain with quartz & glass frit (clockwise)

A test was carried out on the form which related to the *Emergence* series of artworks (see section 4.9), the Prepared Philips glass frit was mixed with a prepared aggregate of high fired bone china and quartz mix and packed into a blown glass ring; fired to 705°C, soaked for 15 minutes and annealed (see Figure 97). When fired the test retained its form as a whole and no cracks and stresses were visible, when viewed under the *Polarimeter* no stress could be detected. This demonstrated that the system was balanced and was therefore a stable, compatible test (see Materials Testing Sheet 3Eii, Appendix 5).

Figure 97 Kelly, 2009, Route 3 Test 3Eii, Bone China with quartz & glass frit

Similar tests were also carried out on the forms which related to the *Wedge* series of Artworks (see section 4.12); however a pre-fired kiln cast form in Gaffer casting glass was used instead of a blown glass form, these tests will be discussed further in this chapter (see section 3.11).

3.9.4 Process Route 4: The combination of a ceramic core with hot glass

The bone china body and the porcelain body were mixed with quartz (in a 1:1 Ratio) slip cast and high fired and crushed into aggregate chips, these were then heated up in a pick up kiln to 500°C. A layer of glass was hot poured into a square form; the chips were then transferred to the glass. Another layer of glass was then hot poured over the top and left to cool before being annealed (see Figure 92). A further set of tests were carried out using blown and solid hot glass forms, the prepared bone china and porcelain aggregates were heated up and picked up on a hot glass form which was then gathered over again with a layer of hot glass, shaped and allowed to cool and annealed (see Figure 98). Both series of tests survived the annealing process, no visible stresses and cracks occurred; no stress could be seen under the *Polarimeter* within the Bone China body however the Porcelain body did show stress. This demonstrated that the bone china system was balanced and was therefore a stable, compatible test and that the Porcelain system was not a suitable test (see Materials Testing Sheet 4F, Appendix 5).

Figure 98 Kelly, 2009, Route 4 Test 4Fv Bone China & Test 4Fviii Porcelain, both with quartz & glass frit

A series of similar hot poured tests were also carried out which related to the collaborative project that was carried out with Professor Steve Dixon. The *Spode* Bone China that Dixon had supplied was unfortunately incompatible, however quartz and cellulose was added to the *Spode* Bone China mix. This series of tests with the added quartz survived the annealing process, no stresses and cracks occurred and no stress could be seen under the *Polarimeter*. This demonstrated that the system was balanced and was therefore a stable test (see Materials Testing Sheet 4G, Appendix 5).

3.10 The selection of an Opaline casting glass

Crystallization or devitrification of glass can cause problems in manufacture, if crystal growth occurs the optical properties of glass are changed and can become translucent if light is scattered by the crystals. Opal glasses derive their translucency from light scattered from internal crystals, which results in either incomplete melting or crystals growth in the glass as it cooled (Doremus 1994, pp.73-74).

It was decided that white opal glasses would be investigated and the *Opaline #300* casting billets and frit from *Gaffer* glass was selected. This glass is a striking colour (provided in a transparent state) which when heat treated at 620-650°C, creates lead phosphate droplets. As they grow in size and number these crystals interfere with transparency to produce varying degrees of a white semi-translucency or dense opacity in the glass.

A series of tests were created in this white opaline glass, the bone china and quartz (mixed in a 1:1 ratio) were made into high fired aggregate chips which were mixed with *Gaffer* glass frit. This was packed into small pre-cast tests which have been designed with open apertures, which were fired to 700°C and annealed on a glass programme (see Figure 99). No stresses and cracks occurred which demonstrated that the system was balanced and was therefore a stable, compatible test (see Materials Testing Sheet 3G, Appendix 5).

Figure 99 Kelly, 2009, Route 3 Test 3Gi Bone China with quartz & gaffer glass frit

Various test Artworks were also created that mixed the *Opaline #300* with the *Clear #210* casting billets and the bone china aggregate to get a marbled effect that combined transparent and translucent qualities (see Materials Testing Sheet 3J, Appendix 5).

3.11 The selection of coloured casting glass

The option of colour had so far not been incorporated into this study, it was decided that the Gaffer casting glass colours of *Copper Blue #251* and *Steel Blue #253* would be used to introduce some colour into the work (see Figure 100).The same tests as described above were applied in these colours (see Materials Testing 3Giii & 3Gvi, Appendix 5).

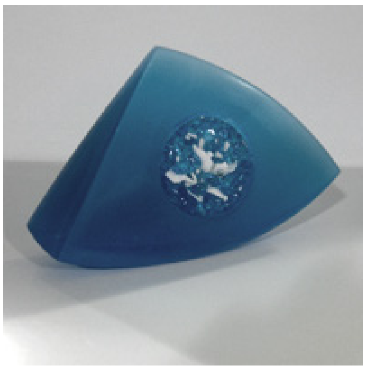


Figure 100 Kelly, 2009, Route 3 Test 3Giv-3Gv Bone China with quartz & gaffer glass frit

A test was also carried out in the *Steel Blue #253* to create a larger form (see Figure 101) fired with the bone china aggregate which was set in large quantities into the main body of the glass and fired to 825°C in one casting in a plaster and malachite mould (see Materials Testing Sheet 3Hi, Appendix 5). No stresses and cracks occurred in this test which demonstrated that the system was balanced and were therefore a stable, compatible test (see Figure 102).

Figure 101 Kelly, 2009, Route 3 Test 3Hi Bone China with quartz & gaffer casting glass, 20 x 26cm

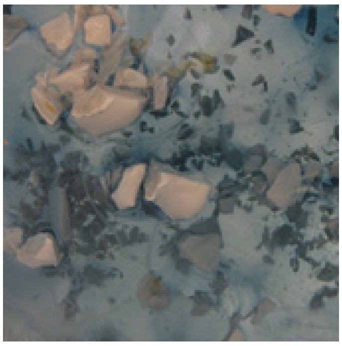


Figure 102 Kelly, 2009, Route 3 Test 3Hi Detail Bone China with quartz & gaffer casting glass

3.12 Summary of Materials Testing

The initial Material Testing Phase demonstrated that a compatible clay body that matched the expansion rate of the *Philips* and *Gaffer* glasses needed to be identified. The final Material Testing Phase, especially the tests conducted with Bone china from *Pottery Crafts* with the addition of quartz produced a series of tests that were compatible with the glass, without any visible cracks and stresses. This clay body produced a stable and balanced system which achieved the visual aesthetic and practical requirements as previously set out by this research project (see section 3.1). Limitations were however encountered in forming the bone china body with added quartz into large scale forms; which suggested that the new clay body is not suitable for larger, more complex ceramic forms. Further tests will need to be conducted with added fillers such as grog and paper pulp as part of future research to improve the strength of the clay body (see section 6.7).

4. Artworks

This Chapter relates to aim and objective 2 of the research to create a body of combined glass and ceramic tests and artworks; in order to demonstrate and articulate the possible creative and practical benefits of the new potential processing routes. In the initial testing phase, four potential process routes were tested in order to map creative parameters of combining glass and ceramics in a hot state. These process routes were then used as the basis for the making of artwork. Each range of artworks is discussed in terms of visual qualities and the practical performance of the artworks to demonstrate the hot state combination of glass and ceramics.

4.1 Rationale for the development of a body of artwork

It was important to make artwork to demonstrate the creative potential and practicality of the material testing phase (see Chapter 3). Key elements of the testing were created on a larger scale in the production of final exhibition artworks. By building on the tests which showed promise and trying out different production methods; it was possible to make artworks that realised the visual qualities of the tests.

Many of the artworks were shown in exhibitions, which enabled the research results to be viewed in a professional way elucidating the impact of the emerging artworks on the field. Acceptance of the emerging artworks into juried exhibitions implies to a certain extent the acceptance of the work in a wider professional context than that of the University faculty. In exhibiting the artworks at Craft and Art galleries it was possible to test the viability of the new process routes and artworks against the work of others in the field. It was not possible to exhibit all of the artworks as some were created towards the final phases of the research; however they will be shown in due course.

The nature of the artwork produced reflects my personal approach which is an interest in the visual relationship between glass and ceramics and the complimentary qualities these materials embody. This approach is revealed through the visual language of the research which has been developed through the emerging tests and artworks. The artistic enquiry has been influenced by the process of experimentation and discovery that has inspired and driven the research forward. By working with key elements of the tests such as the translucent and transparent effects of the materials it was possible to draw the processes together to create a synthesis of surface texture and form. This relationship between the materials is echoed in the textures and forms which have helped to develop a personal visual language.

It has been the mission of this research project to find an artistic voice and framework that is expressed and articulated through the combined and intimate relationships of studio glass and ceramics within my studio practice. The formulation and use of an emerging visual language has been instrumental in the accomplishment of this task. In unpicking and reflecting upon the use of visual language throughout this research project, certain terms became evident such as 'glassiness' which will be used in this chapter to describe the form of glass and the varied degrees of transparency associated with its production. This term was contrasted with the introduction of a word 'ceramiciness' which was coined to describe the form of ceramic and the varied degrees of translucency. In utilising these words it was possible to describe the boundaries that blur between the two materials when they are combined to create varying degrees of 'glassiness' and 'ceramiciness'.

The artworks have also been influenced by the combined histories of glass and ceramics, from the initial enquiries of alchemy to the industrialisation of the materials as leading decorative mediums, to the development of glass and ceramics within the broader context of the studio craft movements; as previously discussed in the Contextual Review (see Chapter 2).

Two main bodies of artworks were created; the first examined the surface texture and finish of the piece which took preference over the glass and ceramic form and related to Process Route 2: The combination of a ceramic setter with glass frit. The simple ceramic vessels developed are a vehicle for the more complex surface texture (see section 4.2 – 4.7). These artworks were the initial focus of the research and the surface texture was the main visual interest over the form. These vessels are decorative non functional craft objects. Intended for floor or wall based display these pieces are decorative rather than functional objects. In the *Flint, Spear, Shell & Skim* series simple, almost Neolithic or stone age forms were created to allude to the combined histories and imagined primary uses of these materials as discussed in the Contextual Review, (see section 2.2).

In the second body of artworks, form takes primary position over surface texture. Small, supporting textured apertures of the glass and ceramic mix are featured within the framework of a larger scale artwork and are related to Process Route 3: The combination of kiln cast glass with ceramic aggregate. The aim of this series of artworks was to move away from surface texture towards free standing artworks. The artwork produced was linked to art and design research methods as previously outlined (see section 1.7) which were used to generate ideas for the final glass and ceramic artworks that would be produced. Initial sketches and models were created and technical notebooks and journals were kept to track the progress of the research before the final artworks were completed. This approach was employed to ensure a systematic approach and methodology. These research methods were also used to bridge the gap between the testing phase and the production of artworks. These methods will be discussed as each artwork is described in this chapter.

4.2 Initial starting point for Artworks

As previously discussed in Chapter 1, the *Balanced* artwork (see Figure 1) was created as part of my final undergraduate show in June, 2001; which influenced the initial starting point for this research project. This artwork was concerned with drawing contrasts in form and surface between a hollow slip cast form opened up with surface decoration (created by cutting small olive cuts on a diamond engraving wheel); a long curved glass rod is set through the centre of this piece to create a point of tension passing through the form, lifting it up from the surface of the display plinth. This sculptural piece was created in a cold state.

In reflecting upon my starting point for the research; it made sense at this stage to look again at my initial research question: why combine Glass and Ceramics in studio practice? In questioning the intention of my own studio practice complementary visual qualities were identified in the materials of glass and ceramics; which saw the processes and raw materials crossover in my artworks. This was directed by my intention to express the relationship between glass and ceramics through a process of experimentation. This research project has allowed me to pursue my studio practice to a higher level by formulating a practice based research approach that allows for selectivity and analysis; led by the process of 'designing through making'. By employing working methods such as hands on experimentation and know-how (tacit knowledge) it has been possible to actively experience and reflect upon the making process. A strong connection between my ideas and the combined materials of glass and ceramics has been found. I try to translate this into my practice, my ideas are realised in the use of the materials, bringing together my intuition, instinct, sensory and tacit knowledge of glass and ceramic processing. An awareness of my own development has involved a conscious reflection of my approach: from post graduate, to my professional practice and activity within the wider art and design community. The research process has developed an independence of thought which allows me to work autonomously and to remain self motivated.

4.3 Encircle, Merge, Translucence and Torn

This range of artwork was produced for a *Crafts Council Solo Showcase* at the National Glass Centre, Sunderland in July 2006 (see Figure 102 & Figure 104). This exhibition was curated by the Crafts Council in partnership with the National Glass Centre in order to focus on emerging glass artists.

Figure 103, 2006, Exhibition Overview – Photographed by Jessamy Kelly 42 x 42 x 5cm Crafts Council Solo Showcase, Sunderland

An initial range of artworks were created at the start of the research project such as *Translucence* and *Torn* which demonstrated the creative potential of the process routes identified in the initial testing phase. Other artworks such as *Encircle* combined glass and ceramics in a cold state. At this early stage of the research it was not possible to create this piece in a hot state and *Merge* (see Figure 109) also showed an idea for a glass form that had not been resolved to include both glass and ceramics.

Figure 104, 2006, Torn & Translucence (In situ) – Photographed by Jessamy Kelly Crafts Council Solo Showcase, Sunderland

It was felt that this showcase would be a suitable way to present the emerging artworks of the research. The *Encircle* series (see Figure 105 – Figure 108) are composed of blown glass rings which have been blown as a cylinder and then cut up into single rings, which have then been shaped into simple fused vessel forms and sandblasted to create a matt surface. *Encircle* combines discs of high fired porcelain which have been UV glued in a cold state to the surface of the glass.

Figure 105 Kelly, 2006, Encircle I – Overview, Photographer David Williams, 36x36x6cm


Figure 106 Kelly, 2006, Encircle I – Detail, Photographer David Williams


Figure 107 Kelly, 2006, Encircle II – Overview, Photographer David Williams, 36x36x10cm


Figure 108 Kelly, 2006, Encircle II – Detail, Photographer David Williams

The *Merge* series (see Figure 109) is a similar concept but made from free blown glass rings which have been fused together to create a vessel that has a soft, pliable finish; although this artwork does not feature ceramics, it demonstrates the development of a form that has been used later on in the research in the *Emergence* series.


Figure 109 Kelly, 2006, Merge – Overview, Photographer David Williams, 36 x 36 x 7cm

Merge was featured in the 2007 *New Glass Review 28*, which is an annual publication organised by the Corning Museum of Glass, in Corning New York, which is a worldwide competition to select 100 images of new works in glass. The *Merge* artwork was described by Oldnow *(2007, p.74):*

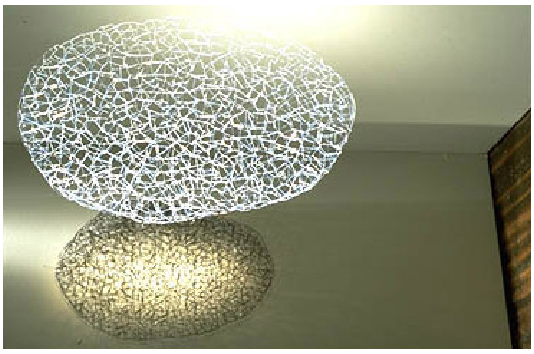
> *Blown glass that is not cold worked or etched is inevitably hard and shiny, but Jessamy Kelly and Charlotte Hughes have managed to convey a sense of malleability in their work… In Merge, Kelly fuses her blown shapes to give the sculpture a sense of hardness and softness, like an inner tube.*

Based on the theme of *Multiplicity* the *Encircle* and *Merge* ranges use the clustering effect of small elements to form a larger whole, this approach was first used in my work to create larger scale artworks from smaller elements. These works were inspired by female glass artists such as Masami Koda, Joceylene Prince, Anna Skibska and Kait Rhoads, who use small individual forms en masse to create larger sculptural artworks, which is echoed in my own approach. Skibska's work comprises of suspended lamp worked glass sculptures made from multiple element compositions which resemble ghost-like figures (see Figure 111)

Figure 110 Kelly, 2006, Merge – Detail, Photographer David Williams

Kangas (2000, pp.26-29) discusses below a feminine approach to contemporary glass making: 'femclusters' which he claims to be a new sculptural paradigm:

> *Koda, Prince, Rhoads and Skibska are all creating images of generative growth, protective forms, open linear networks and clusters of circular, feminine forms. Femcluster is a term that might describe this cumulative effect. Each artist in her own way contributes to the private terrain of Femcluster: by gathering and piling up pieces of glass that result in open-ended forms redolent of outward growth and open visibility*.



I would like to propose that my work fits within this paradigm and contributes to the ongoing development of this approach; especially in relation to Skibska's work, (see Figure 111).

Figure 111 Skibska, 2000, Lampworked glass suspended

Translucence was created as a one off artwork (see Figure 112) it features a pre-fired pâte de verre disc of glass frit and crushed porcelain aggregate which was fired to around 650°C and was set within a large blown glass disc.

Figure 112 *Kelly, 2006,* Translucence Overview, Photographer David Williams 42x42x5cm

This artwork relates to Process Route 3**:** The combination of kiln cast glass with ceramic (see section 3.4.3). It is possible to see small visible surface cracks in this artwork, which is caused by the incompatibility that exists between the two materials. The use of a blown glass base plate helps to protect the fragility of the pâte de verre disc which creates strong contrasting shadows around the work when direct light is shone through the piece. A cut blown glass element has been added to this composition to create a focal point for the artwork, the shape is representative of a sharp tool which has been cut and polished on the top surface and intricately cut on the back with small olive cuts; in line with the emerging visual qualities of the research (see Figure 113).

Figure 113 Kelly, 2006, Translucence – Detail, Photographer David Williams

Torn is another one off artwork (see Figure 114) it features a slip cast porcelain vessel form and relates to Process Route 2: The combination of a ceramic setter with glass frit (see section 3.4.2). This artwork was purposefully split in two by letting the two pieces split in the drying process, under its own weight (if not supported by the mould the green state ceramic will split if dried quickly); this technique was used purposefully to achieve this effect. Each piece was then cut at the biscuit fired state with a diamond wheel to create multiple olive[61] shaped indents in the ceramic surface; which were then filled up with glass frit and high fired in a ceramic kiln to 1280°C. Small cracks are visible in the ceramic surface which has made the glass frit crack very slightly, at a later stage in the research the glass was added after the final high firing and was fused and annealed at a much lower glass melting temperature of around 750°C (see section 4.7). When cutting the porcelain care was taken to create thin areas of translucency to introduce small windows of light. [62] Blown glass egg forms which were also diamond cut with olive shaped indents, which were made to complete this composition.

Figure 114 Kelly, 2006, Torn – Overview, Photographer David Williams 50 x 40 x 10cm

It is possible to see the crackled surface of the glass mirrored in the blown glass forms which suggest a relationship between the two materials; the glass resembles a macroscopic version of the ceramic surface as if seen through a lens (see Figure 115). The blurring of techniques between glass and ceramics is apparent in the use of traditional glass making techniques such as diamond lathe cutting. The cutting of the biscuit fired ceramics on the diamond lathe is a practical way of manipulating the ceramic surface as it is much more stable in a biscuit state than in a green state. In contrast to the ceramicist Wardell who is renowned for cutting away or incising her work

[61] A term used to describe an oval cut that resembles an olive.
[62] The surface of the porcelain had to be cut to approximately 2 or 3mm to achieve translucency, this can be quite difficult to do as great care has to be taken as a hole can easily be made; however relatively speaking it is still easier then cutting in the green state.

in the green state to create areas of translucency (Wardell, 2004, pp.86-87). Processing in the biscuit fired state avoids difficult handling issues; it also aligns the material qualities with glass, in effect treating 'like with like' to create a visual connection between the two mediums. Although *Encircle I* & *II* and *Merge* do not demonstrate the hot state combination of glass and ceramics these artworks were a way of visualising an idea that could not be realised at this early stage in a hot state. This is significant to the development of the artworks and these pieces should be viewed as working models for artworks such as the *Emergence* series (see section 4.8 & 4.9) which were created at a later date.

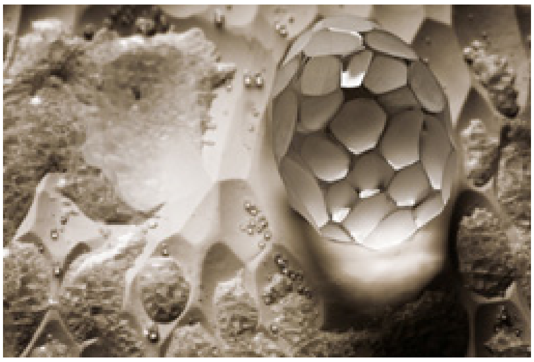


Figure 115 Kelly, 2006, Torn – Detail, Photographer David Williams

In relation to *Translucence* and *Torn,* it was important to consider the practical aspects of production and the visual qualities of combining glass and ceramics. It is apparent in the visible surface cracking of these artworks that the combined system of glass and ceramics is incompatible. At this early stage in the research it was decided that until the combined system was improved the 'crackle' effect would be used. This demonstrates the difficulties that were occurring in the initial testing phase of the research and visualises the tensions that occur between glass and ceramics.

The main practical problem encountered during the making of the artworks, was related to the incompatibility of the materials. It was noticed in early tests that this incompatibility issue caused the pâte de verre and ceramic mix to become very fragile.[63] In the case of *Translucence* this issue was partially resolved by setting this mix into a large base plate to support the surface area. This enabled a complete whole to be achieved that could be easily handled and transported; thus creating a final artwork. Despite the problems identified the discussed artworks were of exhibition quality, as the surface cracking was controlled and the pieces remained in one piece. The

[63] Pâte de verre is known to be a fragile material, which can be difficult to handle especially if the work has to be transported to an exhibition.

incompatibility issues did not affect the display of these pieces, however a design with more open surface areas or without a base plate would not have been suitable and would have most probably not survived.

As the first series produced for exhibition this range of artworks was successful in that it presented the early results of the research in a professional manner. The production of additional artworks was however deemed necessary in order to gain a deeper understanding of the creative potential of combining glass and ceramics.

4.4 Displace and Wings

In October 2006, the *International Glass Symposium* (IGS) invited glass artists to attend a practical symposium and exhibition organised by the Crystalex Glass Factory, in Novy Bor, in the Czech Republic.[64] It was possible to work alongside talented craftsmen in the hot and cold workshops of the factory (see Figure 116 & Figure 117), to create a range of artworks for presentation at the finale exhibition. The *Displace* and *Wings* series were created; it was not possible to work with ceramics at this symposium so white opaline glass was used in order to imitate the characteristics of white ware ceramics. In using the white glass that was used commercially at the factory it was possible to experiment with a new type of glass and to develop new forms and deeply cut surface textures. The historical precedent of 'Milk glass' is the inspiration for this enquiry into glass imitating ceramics, as previously discussed in the contextual review (see section 2.2).

Figure 116 2006, Displace - diamond wheel cutting (left), diamond saw cutting (right) – Photographed by Jessamy Kelly, IGS, Novy Bor, Czech Republic

[64] With Professor Sylva Petrová as their creative director.

Figure 117 2006, Wings – (Kelly) diamond wheel cutting - Photographed by Symposium organiser, IGS, Novy Bor, Czech Republic

Displace was a one off artwork (see Figure 118) which was retained by the IGS for their permanent collection and involves the assembly of white blown glass elements as a composition. Two round spherical forms fit into two large undulating open base forms. The inside of the round forms were coated in a reflective mirrored oxide which was fired onto the surface to draw light and reflection into the piece (see Figure 119). This was a new technique that had not been used before and was a way of capturing and transmitted light. The white glass surface of the form were left glossy and highly reflective, whilst the smaller cut elements were diamond cut and left matt to create a contrasting effect; highlighting the diverse range of 'glassiness' in the surface of the piece.

Figure 118 Kelly, 2006, Displace – Overview, Photographed by Jessamy Kelly (in situ) 70 x 67 x 34cm & 65 x 60 x 34cm, IGS, Novy Bor, Czech Republic

Figure 119 Kelly, 2006, Displace – Detail, Photographed by Jessamy Kelly (in situ), IGS, Novy Bor, Czech Republic

Wings is part of a series of sculptural artworks (see Figure 120 & Figure 121) that were also created at the Symposium. Each blown glass piece was diamond cut on the industrial cutting lathe at the Crystalex glass factory. The large scale blown glass pieces were cut with deep olive cuts which were made possible by working alongside talented glass cutters and observing how it was possible to cut such large pieces by hand. Again, the white glass was used to imitate a ceramic style; the glass emulated a glazed white ceramic body.

Figure 120 Kelly, 2006, Wings – Overview, Photographer David Williams 60 x 50 x 6cm

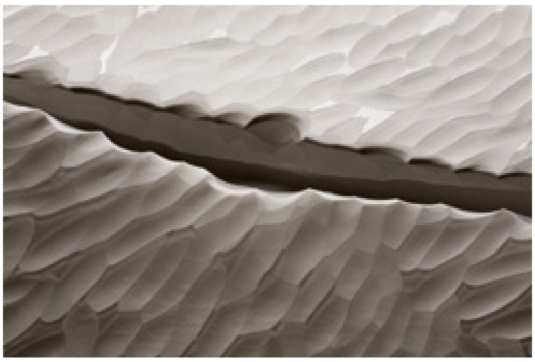


Figure 121 Kelly, 2006, Wings – Detail, Photographer David Williams

These ranges do not relate directly to the research as no ceramic is present in these artworks; however the techniques and scale of the work were inspirational and helped to refine and further develop the emerging visual language. These artworks draw links with historical and contemporary artworks that use glass to imitate a white ceramic as previously discussed in the Contextual Review (see section 2.2). This series should be viewed alongside the research as sources of inspiration for the artistic intention of the research.

4.5 Fragments

In November 2008, curators from the *Designed & Made* Gallery in Newcastle upon Tyne and the *DLI Museum*, in Durham presented an exhibition entitled *Flawed Inspiration*. They invited artists to submit proposals that examined the theme of 'inspiring flaws': where the outcome of a piece of work was not intended, but with which you are pleased - *the result of a mistake/ damage/ accident, the unpredicted reaction of materials, an error of judgement.* This was an ideal way to demonstrate the compatibility issues that had been encountered in the material testing phase and the way that the resulting cracks and stresses had been used in some of the artworks as a *flawed inspiration*.

Figure 122 Overview of Flawed Inspiration, 2008, photographed by Helena Seget

It was also a way of showing how the materials incompatibility has become part of the visual qualities of the early studio work and has been used as an inspiration. A series of artworks and test tiles were also shown to present how this research project had progressed and to expose the research process. Additionally, a range of engraved glass prints were made at the start of this project to design the artwork and to work out how the composition might work. To create an engraved glass print, a sheet of float glass is cut on a diamond lathe or engraving wheel, ink is then applied to the plate and a print taken from the plate; as the print develops the plate can continue to be cut to create a more intricate design. This approach was an important way of developing visual studies to plan and support the making of the final artworks.

The *Fragments* range (see Figure 123 & Figure 124) was created as a one off artwork, it features solid slip cast porcelain forms which were either purposefully split in two or cut with a diamond wheel to create interlocking edges and flowing outlines. This range was exploratory and was developed organically through the making process, which allowed for the creative potential of combining glass and ceramics to be revealed through the techniques. Each piece was marked with a PVA glue mask which was drizzled on in a similar way to the traditional techniques of slip trailing. Each piece was then sandblasted at the biscuit fired stage to create a series of organic swirling patterns in the ceramic surface. When sandblasting the porcelain care was taken to create thin areas of translucency introducing small windows of luminosity to the artwork. The ceramic forms were then high fired to 1280°C and then packed with glass frit and fired to around 725°C using a glass firing schedule. This series relates to Process Route 2: The combination of a ceramic setter with glass frit (see section 3.4.2).

Figure 123 Kelly, 2008, Fragments – Part of series, 1 of 9, Photographer David Williams 42 x 36 x 5cm

Once again the blurring of techniques between glass and ceramics is apparent in the use of traditional glass making techniques such as sandblasting juxtaposed with the PVA masking technique, which mirrors a slip trailing technique associated with traditional ceramic decoration. Sandblasting the biscuit fired ceramics is an effective way of manipulating the ceramic surface when it is in a stable biscuit fired state. This approach again aligns the ceramic surface with glass treating '*like with like'* to create a visual and processing connection between the materials.

Small cracks are visible in the ceramic surface which has made the glass frit crack very slightly, these visible flaws are controlled which means that this range is of exhibition quality. The main disadvantage indicated by the making of this range of early artworks was the incompatibility of the materials, which limited the form and scale of the work. Flat vessel forms with wide open surface areas set into ceramic setters for firing were necessary. It was felt at this stage that the artworks and the creative process had been somewhat limited by the difficulties encountered with the materials. In reflecting on the making of the Fragments range, it became evident that certain visual qualities had been compromised in order to achieve a finished artwork.

Figure 124 Kelly, 2008, Fragments – Detail, Photographer David Williams

4.6 Flint, Spear, Shell and Skim

The simple *Spear, Skim and Flint* artworks (see Figure 126, Figure 129 & Figure 131) were created in solid slip cast porcelain which were then cut with diamond wheels at the biscuit stage and then high fired to 1280°C (see Figure 125). The glass frit was fused in a separate firing at 725°C, this series relates to Process Route 2: The combination of a ceramic setter with glass frit (see section 3.4.2).

Figure 125 Kelly - Spear being cut on diamond lathe, 2008, Photographed by Joanne Mitchell

This series of ceramic forms allude to Neolithic[65] shapes and suggest early vessels, tools or weapons (see Figure 126 – Figure 127). The high fired forms were then fused with small grains of glass frit to create delicate droplets of glass which emulate morning dew or rain drops; a technique influenced by the work of Takahiro (see Figure 49).

[65] Relating to the later part of the Stone Age.

Figure 126 Kelly, 2008, Flint – Overview, Photographer David Williams 65 x 60 x 2cm

Figure 127 Kelly, 2008, Flint – Detail, Photographer David Williams 25 x 6 x 2cm

The artworks in this range again refer to the traditional studio glass making techniques of diamond cutting and engraving; by cutting the ceramics using glass equipment the crossovers between the two materials in terms of processing is evident. By treating the materials in a similar way the connections between glass and ceramics are highlighted which is apparent in the dominant visual qualities of the final artworks. A series of engraved glass prints (see Figure 128) were created as part of the process and were used as inspiration for this series of artworks.

Figure 128 Kelly, 2008, Series of Engraved Glass, related to diamond cutting

The crossovers and links that can be observed between these ranges indicate the amalgamation and blurring of boundaries between glass and ceramic processing. The fluid approach that has been applied when making this range of artworks makes reference to both disciplines and is an artistic interpretation of the creative possibilities of combining glass and ceramics.

Figure 129 Kelly, 2008, Spear – Overview, Photographer David Williams 45 x 35 x 3cm

Figure 130 Kelly, 2008, Spear – Detail, Photographer David Williams 45 x 8 x 3cm

Figure 131 Kelly, 2008, Skim – Overview, Photographer David Williams 46 x 38 x 2cm

Figure 132 Kelly, 2008, Skim – Detail, Photographer David Williams 12 x 14 x 2cm

The *Shell* form (see Figure 133 & Figure 134) moves these artworks towards the form of a vessel; which resembles a simple bowl. Seen as a study of form, this series of artworks are to be viewed as exploratory. In display as a group, they appear as a series of forms that reference ancient artefacts, relating to the early historical links between glass and ceramics (see section 2.1).

Figure 133 Kelly, 2008, Shell – Overview, Photographer David Williams 12 x 15 x 2cm

Figure 134 Kelly, 2008, Shell – Detail, Photographer David Williams 32 x 34 x 2cm

Intended to be shown together as a floor based installation this series creates a *sea* of surface texture patterns that blends and merges throughout these simple forms to present the combined visual qualities of glass and ceramics. The use of repetition and multiples has been a common theme in my work in order to realise a conceptual level; which has been extended by using techniques such as the clustering of artworks within a space to create a site-specific installation.

A similar approach, that explores the display of multiple forms based on early vessels, weapons and tools; can be seen in the work of the US glass artist William Morris who is inspired by ancient artefacts and relics. His *Artifact panel* (see Figure 135) which represents a series of 350 small scale glass sculptures relating to ancient reliquaries that resemble bone, stone, pottery shown are shown as a collective installation on a 50ft wall (Klein, 2001, pp.152-155).

Figure 135 Morris, 1998, 'Artifact panel', blown glass and steel 243 x 980cm

In examining the performance of this series of artworks, again small cracks are visible in the ceramic surface which has made the glass frit crack very slightly, these visible flaws however were controlled which means that this range is suitable for exhibition. In terms of form it was felt that these artworks were somewhat limited in form. The strength of this series is the way the forms act as a secondary carrier of a unique surface texture that demonstrates the combined glass and ceramic system.

4.7 Honeycomb

In January 2006, the *European Ceramic Work Centre (EKWC)*, in the Netherlands held a masterclass which was run by the internationally renowned ceramicist Piet Stockmans. This involved a one week artist's residency working with mould making and slip casting techniques and a range of Imerys [66] porcelain and bone china bodies. This was a great opportunity to present the research project to other artists on the master class; as part of a small exhibition and group critique (see Figure 136).

[66] A range of French porcelain and bone china ceramic bodies.

Figure 136 Group critique with Piet Stockmans and series of tests carried out at the Piet Stockmans Masterclass, 2006, European Ceramic Work Centre

This trip was influential in the development of the 'Honeycomb' series of work; which involved the introduction of colour and deep surface texture into the porcelain body by mixing pigments into the slip and adding burn out materials: such as pasta, rice, paper and cardboard (see Figure 137).

Figure 137 Series of tests carried out at the Piet Stockmans masterclass, 2006, European Ceramic Work Centre

The Honeycomb series (see Figure 139) was developed to create artworks that had a burn out material in them which introduced small open areas where small glass rods were fused into these openings. Initial tests for this range were created by dipping paper pulp forms such as egg cartons and corrugated cardboard into the bone china body at the wet slip stage (see Figure 138).

Figure 138 Series of initial tests and process images for the Honeycomb range, 2008, Photographed by Nick James

This testing followed on from the series of tests conducted at the EKWC, which helped to develop some new surface techniques which were then applied to the final *Honeycomb* artworks to produce delicate and fragile finishes.

Figure 139 Kelly, 2008, Honeycomb I - Overview, Photographer David Williams, Porcelain & glass frit, 34 x 34 x 6cm

Figure 140 Kelly (2008) Honeycomb I - Detail, Photographer David Williams

The visual approach of the *Honeycomb* series was to create an organic, raw surface texture that burnt out to create small apertures which could be filled with glass to create artworks that combined glass and ceramics. Although quite raw in the finishing, this range was intended to be experimental and a quick way of creating interesting internally moulded forms with dense areas of texture. The *Honeycomb* range relates to Process Route 2: The combination of a ceramic setter with glass frit (see section 3.4.2).

This range was created with the porcelain body and was high fired to 1280°C and then fuse fired with glass frit at 780°C. This range was designed as shallow vessels that could be easily set into a ceramic setter during firing to protect the form when it is high fired. Small cracks are visible in the surface of this range as the porcelain body is not compatible with the glass.

4.8 Torn II and Balanced II & III

Torn II and Balanced II and III artworks were intended to revisit the original *Torn and Balanced* artworks. *Torn II* is a one off artwork (see Figure 119) which features a slip cast vessel form and relates to Process Route 2: The combination of a ceramic setter with glass frit created earlier on in the research. This piece was however made later on in the research to demonstrate the visual qualities and practical application of the bone china body.

Figure 141 Kelly, 2008, Torn II – Overview, Photographer David Williams, Bone china & glass frit 80 x 80 x 9cm

Figure 142 Kelly, 2008, Torn II – Detail, Photographer David Williams

Balanced II is also a one off artwork (see Figure 143 & *Figure 144*) which was made in porcelain slip, biscuit fired and cut on an engraving lathe using the diamond engraving wheel to cut small very deep olive indents into the surface. These cuts pierced through the white, unglazed layer of slip through to the blue second layer of slip (which was pre-coloured at the liquid slip stage with a copper carbonate). Around each pierced cut is a fine ring of translucency which when back lit focuses light around the pierced cut.[67] The overall effect is a densely cut artwork that captures subtle translucent effects.

Figure 143 Kelly, 2008, Balanced II – Overview, Photographer David Williams, Porcelain & glass frit 45 x 50 x 7cm

Figure 144 Kelly, 2009, Balanced II – Detail, Photographer David Williams

[67] The ring of translucency is approximately 1-2mm thick.

Balanced III is a one off artwork (see Figure 145) which was cut on a cutting lathe (not on an engraving lathe). This range continues with the diamond cutting technique and visual style, as previously discussed (see section 4.6).

Figure 145 Kelly, 2009, Balanced III – Overview, Photographed by Jessamy Kelly, Porcelain & glass frit, 120 x 6 x 7cm

Figure 146 Kelly, 2009, Balanced III –Detail, Photographed by Jessamy Kelly

Balanced III was left uncoloured and unglazed and was cut at the biscuit stage with a wide diamond wheel on the industrial cutting lathe to create very wide, shallow olive cuts that were arranged haphazardly at different angles. This spontaneous cutting gesture was used as a method of capturing light within the ceramic body. In this range the diffusion and illumination of the artworks using directional lighting (in the display) was explored to reflect and transmit light within the artworks. 'Translucency' occurs when a balance of light transmission and light reflection is achieved, which is directly linked to the thickness of the ceramic body; which was cut finely in places to promote this property.

After cutting, the ceramic forms were high fired to 1280°C; the glass frit was then adhered to the porcelain body using glass glue which holds the frit in place. Finally, the artwork was fired on a glass firing schedule at around 725°C which fused the frit to the ceramic. Experiments were initially made using a pâte de verre technique, where glass frit and wall paper paste were mixed to create a wet paste. This technique however created an opaque finish which was not as aesthetically pleasing as the dew like appearance of the transparent glass frit adhered with glass glue which fires totally clear leaving no opaque residue. The opaque results were deemed inappropriate as the visual qualities of this research project intended the glass to be as glossy and transparent as possible, when fused onto the ceramic.

The *Translucence* and *Balanced* ranges are related to principals of duality and the tension and harmony of opposites that can be used to create visual connections. Properties such as 'luminosity' and 'density' and 'refined' and 'raw' have been explored alongside themes of 'perfection', 'fragility', 'balance' and 'tactility'. For tension to be seen between the themes a contrast has to be intentionally made to be noticeable. The use of the fragile and tactile visual qualities of glass and ceramics has been of significance to this research project; the ability materials have to project these qualities is for me, what makes the work beautiful. The quality of the material and the skill applied in working the materials together can result in a perfect balance; a synthesis of form and surface that shows a controlled balance between the maker and the materials.

Both the *Translucence* and *Balanced* ranges relate to Process Route 2: The combination of a ceramic setter with glass frit (see section 3.4.2). The *Torn II* artwork was made in bone china; it was re-created in a larger scale and in a slightly different format from the original *Torn* artwork. The large disc was split into three pieces by slip casting the body in a large disc mould and then taking the form out at the leather hard stage and letting it stand alone, the weight of the piece creates a tension which causes the disc to be torn into pieces. Although controlled there is a raw unfinished visual quality along the join that creates the desired split within *Torn*. The pieces were then biscuit fired and then cut using diamond cutting wheels; the pieces were then high fired at 1280°C and then finally finished off with a glass firing schedule to fuse small facets of glass into the open olive cuts at around 725°C. It was not possible to create the *Balanced* artworks in the improved porcelain body due to the more complicated sculptural form of this hollow slip cast artwork.

4.9 Emergence Vessel series

In 2008, a selection of emerging artworks were created for the *Beautifully Crafted* exhibition, at the *National Glass Centre* in Sunderland (see Figure 147). The making of the *Emergence* range provided a clearer understanding of the potential of combining glass and ceramics in a hot state. This series relates directly to Process Route 3: The combination of kiln cast glass and (high fired) ceramic (see section 3.4.3).

Figure 147 Encircle & Emergence Series, 2008, Photographed by Jessamy Kelly (in situ) Beautifully Crafted, Sunderland

The range demonstrated that the process routes could create new qualities and forms suitable for exhibition, which displayed a new visual approach. In order to progress the research further it was decided that the artworks needed to be developed with small apertures or supporting structures to accommodate the fragile glass and ceramic mix, which would protect it and stop it from crumbling away. The problem was particularly evident in some of the initial pâte de verre tests which were made in Process Route 3: The combination of kiln cast glass and (high fired) ceramic (see section 3.5) and in the early *Translucence* artwork which because of its fragility needed a blown glass base plate to support itself. The form for this range was taken from the initial *Merge* artwork as previously discussed (see section 4.3), which was created early on in the research.

Figure 148 Kelly, 2008, Emergence – Overview, Photographer David Williams 36x36x6cm

Figure 149 Kelly, 2008, Emergence – Detail, Photographer David Williams

The *Emergence* series is a step on from the early *Encircle* and *Merge* ranges which were based on the theme of 'Multiplicity' and the clustering and assembly of small elements to form a larger whole. In this series this approach was further extended by filling up the open apertures with the glass and ceramic mix. This series references sources on a microscopic and macroscopic scale, such as tiny organisms seen through a microscope to pebbles picked up from the beach or the form of rock pools and the ecosystems within them. The form of *Emergence* is similar to a web like structure in which the combined frit sits within.

The work of US Glass artist Jack Wax and British Glass artist Angela Jarman have been influential in the development of the visual qualities of this series; their approach involves the assembly of smaller elements to form a whole. Wax's work (see Figure 150) is based on microbial subjects such as viruses or parasites or nature in the form of seed pods which he represents in the form of assembled cast and sheet glass (Wichert, 2000, pp.34-36).


Figure 150 Wax, 2000, Sheet glass assembled

Jarman's work references a blown up macroscopic form of nature which she assembles in cast glass to create sometimes disturbing yet beautiful artworks (Oldnow, 2006, p.72).

Figure 151 Jarman, 2002, 'Evolution 1'; Lost wax cast 45cm, V&A Collection, London

After the initial *Translucence* artwork was completed early on in the research, a series of tests were created to try and increase the strength of the pâte de verre glass and ceramic mix; by firing the mix higher to create a stronger fusion (see Figure 152). These test artworks demonstrated that the mix was strengthened by a higher firing, with an increased soak time.

Figure 152 Kelly, 2008, Increased strength fired pâte de verre mix, porcelain & glass frit

It was also observed that the ceramic aggregate had to be kept away from the edges of the supporting glass rings as they could create tension marks and cause cracking (see Figure 153). Again, different ceramic bodies were trialled with varying amounts of quartz added into the body, in the end a bone china body with the addition of quartz was deemed as the most suitable for this series of artworks, as previously discussed (see section 4.8).

Figure 153 Kelly, 2008, Tension marks created by incompatible ceramic aggregates

4.10 Emergence II Vessel and Emergence Standing Series

In early 2009, a group of North East glass artists were invited to show their work at the *Artomatic* art fair in Washington DC, which is a major art event in America (see Figure 154). The showcase was linked to the friendship agreement fostered between the City of Sunderland and Washington DC. This was an opportunity to showcase some of the emerging artworks from this research project in a professional and international context.

Figure 154 *Emergence* Range: Standing series & Vessel series, 2009 – Photographed by Joanne Mitchell (in situ) *Artomatic*, Washington DC

The theme of the *Emergence Vessel II & Emergence Standing Series* (see *Figure 155 & Figure 156*) is an extension of the first *Emergence* vessel (see section 4.9) which demonstrates different ways of realising this theme in a larger scale.

Figure 155 Kelly, 2009, Emergence II, Photographer David Williams 70 x 70 x 6cm

Figure 156 Kelly, 2009, Emergence II, Detail, Photographer David Williams

The *Emergence Standing* series was developed in order to lift the artworks up, away from the original vessel forms to create one off pieces that could be back lit and be more open to natural light. This freestanding format helped to display the translucency of the combined materials more clearly to show the varying degrees of 'glassiness' and 'ceramiciness' as previously discussed (see section 4.1). This also supports the intent of the research to enhance the inherent properties of glass and ceramics, to create translucent and transparent effects.

Figure 157 Kelly, 2009, Emergence Standing Series – Detail, Photographer David Williams 15 x 10 x 30cm

Figure 158 Kelly, 2009, Emergence Standing Series –Detail, Photographer David Williams

The performance of this *Emergence* series had the same effect as the original *Emergence* Vessel discussed in the previous section (see section 4.9).

4.11 Spliced

It was decided later on in the research, in early 2009 to create a series of large scale one off artworks in kiln cast glass. The *Spliced* series was developed intentionally to move the artworks towards pure form and away from surface pattern. A range of pen and ink sketches and experimental models were made in plaster which were then cast in gel flex and then in wax (see Figure 159, Figure 160 & Figure 161).

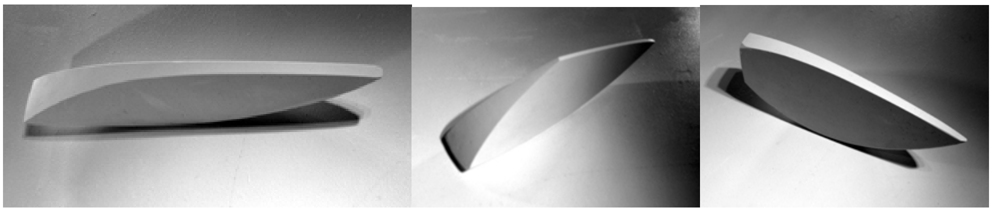
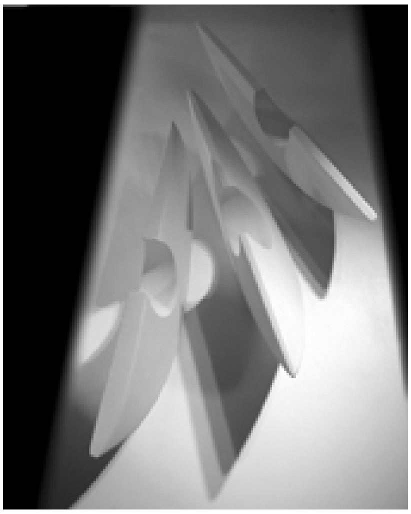


Figure 159 Kelly, 2009, Plaster models for cast glass sculptures



This method was an important stage for this series of artworks and helped to develop a series of strong sculptural forms (see figure 140); initial sketches were also made (see figure 141). Wax casts were then processed using the '*cire perdue'* – 'lost wax casting' technique; whereupon the casting mould is cast onto the wax which is then steamed away to leave the open mould, ready for casting.

Figure 160 Kelly, 2009, Plaster models for Spliced glass sculptures

A range of *Gaffer* glass was used in opaline white, copper blue and steel blue to create this series. These large scale pieces were fired to 825°C using an advanced glass casting and annealing schedule provided by *Gaffer Glass*.[68] After casting the pieces were quite rough and needed to be ground

[68] For more information on Gaffer glass see (www.gafferglass.co.uk).

down using carborundum[69] grit to get a smooth surface on each side; the curved surfaces were smoothed using a linishing machine[70] and diamond pads. When the forms had been totally smoothed, they were then set back into a plaster and malachite mould and the glass and ceramic mix was set into the open area and fused at around 700°C to create the final artwork. This series relates to Process Route 3: The combination of kiln cast glass and (high fired) ceramic (see section 3.4.3).

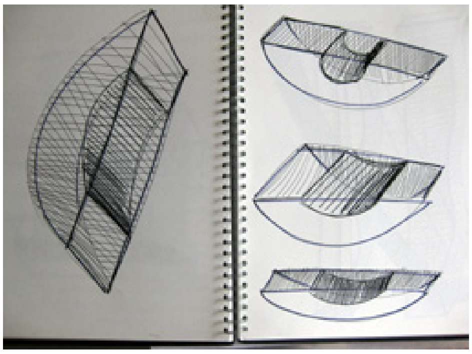


Figure 161 Kelly, 2009, Initial sketches for Spliced, pen & ink drawing

The theme of the *Spliced* ranges is based on studies of form, several simple plaster forms were created which were then studied and measured to create scaled down models. These working models were then trialled as mini artworks before the larger scale artworks were created. The *Spliced* forms resemble slices or segments of a larger whole, which have been cut open to reveal an open core; which has then been packed with the glass and ceramic mix. The core is the central inspiration of the research with the luminous mix at the centre of each of the artworks.

Figure 162 Kelly, 2009, Spliced I White – Overview, Photographer David Williams, 60 x 60 x 20cm

[69] A type of grit that is used when cold working glass, it is available in different grades and is used to grind the surface of the glass flat against a rotary wheel or by hand against a sheet of glass.
[70] A linisher is a glass grinding machine, fitted with belts coated with an abrasive surface to grind and polish glass.

Figure 163 Kelly, 2009, Spliced I White – Detail, Photographer David Williams

The *Spliced* series were created as one off artworks, to be displayed in sets of three. The forms have been set at slightly different angles and weights so that they subtly lean away from each other. The empty core was packed with a mix of glass frit and bone china aggregate. Created in muted, understated tones; the white glass of *Spliced I* (see Figure 162 & Figure 163) imitates the cool, dense surface of porcelain and bone china which creates an enigma about the material origin and perhaps poses the question; is it ceramic or glass? This perceived contention or mystery is an interesting assertion and may leave the viewer uncertain about the materials they are viewing. *Spliced II*, a second series of artworks was created in white and clear glass, to merge the central clear core with the main form (see Figure 164 & Figure 165).

Figure 164 Kelly, 2009, Spliced II White & Clear – Overview, Photographer David Williams 60 x 60 x 20cm

Figure 165 Kelly, 2009, Spliced II White & Clear –Detail, Photographer David Williams

Further artworks were created in Steel blue glass *Spliced III* and Copper Blue glass *Spliced IIII* (see Figure 166 & Figure 167), *which* are highly polished and very glossy pieces, displaying distinctive glass qualities; these artworks have a very different visual style to *Spliced I*. When displayed together the artworks demonstrate the diverse qualities that has emerged from the research; drawing associations across a range of translucent and transparent effects.

Figure 166 Kelly, 2009, Spliced IIII Copper Blue – Overview, Photographer David Ward 60 x 60 x 20cm

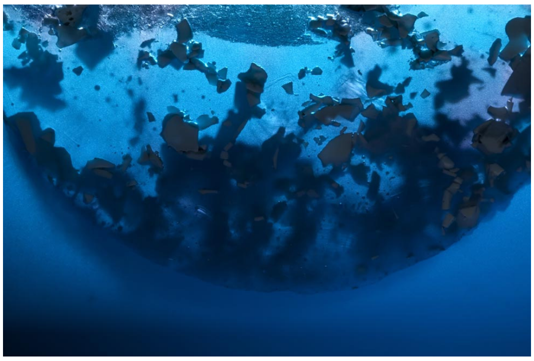


Figure 167 Kelly, 2009, Spliced IIII Copper Blue – Detail, Photographer David Ward

This series of work is a progression on from the *Emergence* series, and was seen as a way of creating a supporting aperture for the glass and ceramic mix using *Gaffer* casting glass. Again, as previously discussed different ceramic bodies were trialled with varying amounts of quartz added into the body, in the end a bone china body with the addition of quartz was deemed the most suitable for this series of artworks (see section 4.9). Furthermore, the bone china body was the closest in terms of visual style to the white glass of the *Spliced I* & *Spliced II* artworks, as the porcelain was body was too creamy and has an off white tone.

4.12 Segment and Wedge

The *Segment* and *Wedge* ranges were created from the plaster models that were created during the research for the *Spliced* forms, as previously discussed (see Figure 168 & Figure 169). Made in solid *Gaffer* casting glass, the apertures of the cast glass sculptures were then filled with the glass and ceramic mix. The *Segment* range is a smaller scale one off series of artworks (see Figure 170 & Figure 171), two elements make up each artwork, which are then designed to be displayed in a set of three. Varying amounts of clear and opaline white glass was used to create a marbled effect within the cast forms; to highlight varying degrees of translucency and transparency within the piece. A mix of clear and steel blue glass frit and bone china aggregate was then fired into the open aperture of the pre-cast form at around 700°C. This series relates to Process Route 3: The combination of kiln cast glass and (high fired) ceramic (see section 3.4.3).

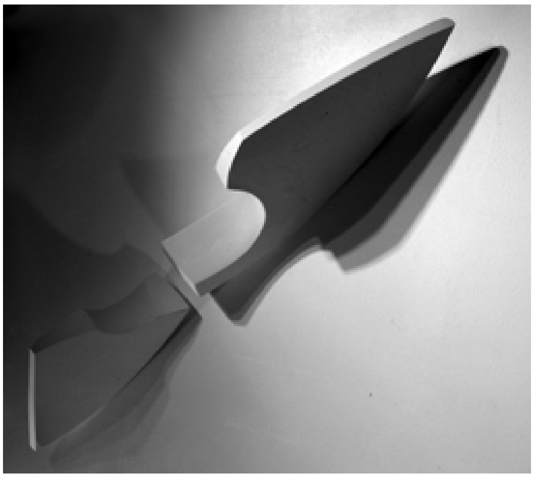


Figure 168 Kelly, 2009, Plaster models for Segment glass sculptures

Figure 169 Kelly, 2009, Plaster models for Wedge glass sculptures

Figure 170 Kelly, 2009, Segment white –Overview, Photographer David Williams,
100 x 50 x 15cm

Figure 171 Kelly, 2009, Segment white –Detail, Photographer David Williams

*Figure 172 Kelly, 2009, Segment white – Detail, Photographer David Williams,
60 x 15 x 6cm*

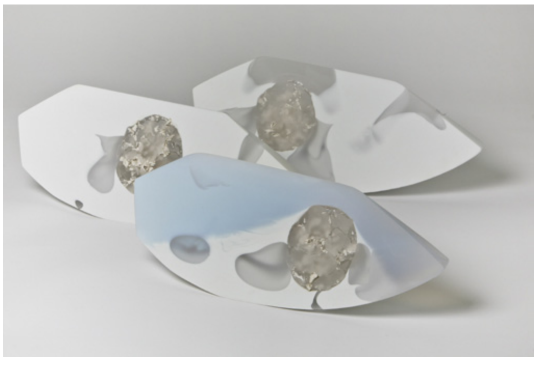


Figure 173 Kelly, 2009, Wedge white – 2009, Photographer David Williams, 40 x 30 x 20cm

The *Wedge* range is a large scale one off artwork (see Figure 173 & Figure 174) designed to be displayed in a set of three; with varying amounts of clear and opaline white glass to create a marbled effect. This marbled effect was used to create varied shades of light within the opaline glass. By firing a mix of the clear glass frit and bone china aggregate into the open aperture of the pre-cast form (as described above); a contrast was created between the solid form and the fused surface. The aperture of this range was set at a different position within each form, so that when shown together the aperture moves within the form to create a varying focal point. When displayed using directional lighting the light hits each piece in a different way, which draws attention to the varied range of translucent and transparent effects within this series of artworks.

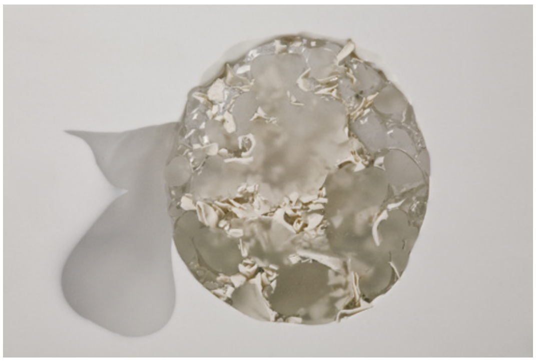


Figure 174 Kelly, 2009, Wedge white – 2009 Detail, Photographer David Williams

In terms of practical performance, this series of work is an evolution of the *Spliced* series as previously discussed (see section 4.11) and also successfully integrates the improved bone china body with added quartz within the glass and ceramic mix.

4.13 Coast

The *Coast* wall panels (see Figure 176 & Figure 177) were the final artworks to be created for this research project. The intention of this range was to draw parallels between the research and some of the more commercial artworks which have previously been created for the fused art glass company *Juo Ltd*.[71] The aim of this series was to mirror the style of the *Coast* range (see Figure 180). This series relates to Process Route 2: The combination of a (high fired) ceramic setter with glass frit (see section 3.4.2). The original *Coast* range is created by slumping [72]sheets of float glass over a mould in the kiln at around 790°C.

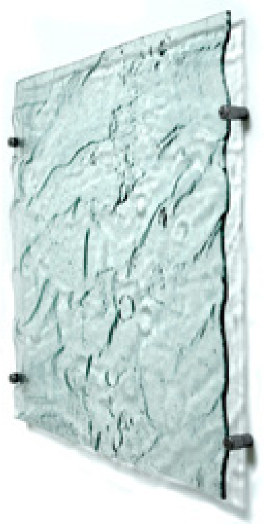


Figure 175 Kelly, 2007, Coast – Overview, Photographer David Williams, Fused Glass, 50 x 50 x 1cm

The moulds for the new series were prepared in a similar way, by taking a gelflex[73] of the original cast sand drift patterns, which are then moulded in plaster and used as the base form. The *Coast* panel was slip cast in porcelain, the slip was poured over the mould and allowed to set until leather hard, the sheet of porcelain was then carefully peeled away from the mould and allowed to slowly dry out. The sheet was then carefully split down the centre to create a line of tension similar to the Torn artworks (see section 4.3). The piece was then biscuit fired and smoothed down with wet and dry paper. The panel was then high fired to 1280°C and then finally finished off with a glass firing schedule to fuse small facets of glass into the drifted sand forms at 780°C.

[71] For further information on *Juo Ltd* see (http://www.juoltd.com).
[72] *Slumping* is a technical term for a firing phase when glass bends when heated in a kiln.
[73] *Gelflex* is a type of silicon rubber which can be heated into a liquid form and used to create a flexible model for plaster mould making that can be used several times.

Figure 176 Kelly, 2009, Coast Wall Panel – Overview, Photographer David Williams 55 x 55 x 1cm Porcelain & fused glass

Figure 177 Kelly, 2009, Coast –Detail, Photographer David Williams

The theme of the *Coast* range was to work on a commercial project that could be realised within the structure of an existing studio glass business. In order to present the techniques of combining glass and ceramics that could be sold in a commercial studio gallery. This range relates to an ongoing theme in my work, which examines the links between 'Land - Light – Identity' which is connected to the local north east landscape. The *Coast* range was created in porcelain, small visible cracks can be seen in the ceramic surface which has made the glass frit crack very slightly. However, the porcelain body was selected as it was the closest in terms of visual qualities to sand drifted patterns as it has an off white/cream colour.

4.14 Summary of issues and insights raised through the making of artworks

A diverse range of artworks have been created at various stages of this research project that demonstrate the potential process routes of the research using a range of processing techniques. The use of clay bodies with the addition of quartz in some of the artworks discussed in this chapter was an important development for this research project. In testing and pushing the materials beyond their usual limits, this research project has reached beyond the notion of traditional studio techniques and craft to create a new approach and potential model for others. By being actively engaged in ongoing experiments alongside the making of artworks, and using experimental techniques; an experiential approach has been developed. By unpicking and reflecting this approach and the visual qualities of the artworks it has been possible to elucidate some key factors that continue to re-appear in my work, which can be interpreted as the constant themes and personal constructs of my practice.

As a glass and ceramic artist I feel that the dialogue between a maker and their chosen medium(s) is central to development of expressive artworks. This perspective has been developed through the process of reflection and self analysis of my own work and practice which has enabled me to examine previously executed artworks. This process of reflection has been from my practice based perspective, which has involved closely examining the links between what knowledge of combining glass and ceramics has been learnt, how it was acquired (via the research process) and what it means when applied to my practice (the results of the research). This has helped with the understanding of what drives my creative process and how it is positioned within the wider field of glass and ceramics.

5. Case studies and collaborative projects

This Chapter discusses the Case studies that have been carried out in relation to Objective 3; in order to aid the positioning of the research in the contemporary field of practice. Firstly, the rationale for the case studies is established and in turn each study discussed. Secondly, the collaborative projects and the approach that was developed are defined, followed by a description of each collaborative project. Finally, the chapter is summarised and the knowledge that has been gained is stated.

5.1 Rationale for the case studies and collaborative projects

Case studies are an important way of relating the research to the contemporary field, as described by Gray & Malins (2004, p.117) and as put into practice by Johnston (1997) and Metcalfe (2007). The artworks as discussed in Chapter 4 have been developed alongside the work of contemporary artists who combine glass and ceramics within their studio practice. In the Contextual Review, a short overview was written about each artist (see section 2.3); however it was felt that a more in depth study of a selected group of artists would be of further benefit to this study in order to position the artworks within the field.

A series of case studies were carried out on a diverse range of artists that combine glass and ceramics within their practice. Of the sixteen artists that responded to the questionnaire, six combine glass and ceramics in a hot state and the remainder do so in a cold state. The case studies described in this chapter show some of the convergent and divergent approaches to combining glass and ceramics and the diverse visual qualities and forms achieved by the artists in their work. This provides a framework to compare my artworks against, in order to assess the contribution of the research to the field. Additionally, case studies were carried out on two glass artists that create glass that has a ceramic style; in order to further understand their work and to align the research with this approach.

This chapter also examines the individual approaches and style of the artist's work which are used to exploit the visual effects of combining glass and ceramics. These examples have helped to inform some of the processing routes which have been used in the research; as well as giving an in depth insight into the approach of the artists and the ways they have overcome the known difficulties of combining glass and ceramics in their work. An extension of this was to work with two selected artists on a collaborative project; to offer up the research as a model for others in the field. The first collaborative project was arranged with glass artist Criss Chaney who is an emerging artist who was keen to extend her practice. A further collaborative project was made with established ceramicist, Professor Steve Dixon of the Manchester Metropolitan University who wanted to combine ceramics with hot glass.

5.2 The approach taken to the case studies

A diverse range of artists was selected and studied in order to represent a wide view of the field; some are renowned for their work in both glass and ceramics whereas some are relatively new to the field. Their approaches are all varied as is the style of their work. The production methods include the hot state and cold state combination of glass and ceramics. For example: Andrea Walsh's use of slip cast bone china bodies set in a cold state with kiln cast glass, to Nathan Anderson's thrown ceramic vessels trailed with blown hot glass, to Alfred Spivack's use of a glazed ceramic setter fused with small pieces of sheet glass.

The development of the approach to the case studies began when an initial questionnaire (see appendix 13) which was written and sent out to all of the artists that combine both glass and ceramics, as set out in the contextual review (see section 2.3). Not all of the artists contacted wanted to take part in this case study and some did not want to discuss their techniques. When the final number of artists was confirmed further contact was conducted mainly by email or telephone depending on the artists preference. Due to certain constraints of the research it was not possible to visit all of the artist's studios; however a selection were visited or their work was sought out in galleries and museum collections in order to experience their work first hand.

This gave a practical insight into the approach of the artists; as well as raising some interesting issues relating to the combination of glass and ceramics in studio practice, that had not been previously covered. For example, the various types of glass and ceramic bodies that are used in combination and how some of these have a closer match and are more compatible than others. It also became apparent that many of the materials used are different and it would be difficult to acquire some of the materials depending upon where the artists are based; which make comparison of the artists difficult as many are using local sources.

The first questionnaire formed the basis for the case studies; a further questionnaire was then developed in order to gain a more in depth study of each artist and to unpick their initial answers. By initially posing the same questions to each artist it was possible to structure the case studies, allowing comparisons to be made between the artists as well as establishing the parameters of the field. The questionnaire had a brief introduction to the research and a request for information about their name, their area of discipline, and the materials that they use in their work and the training they have completed. This was then preceded by the following questions and a space for any additional comments:

- *Why do you combine glass and ceramics in your work?*
- *How and when did you start to combine glass and ceramics in your work?*
- *What similarities or links have you experienced in the working of glass and ceramics in your work?*
- *Do you think that there are any particular aesthetics associated with combining glass and ceramics?*
- *What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?*

These initial questions were important to ascertain if the artist did work in both glass and ceramics, when they started doing so and if they had found any technical difficulties when working with the two materials. A further set of more in depth questions were sent out in a questionnaire format which asked the following questions:

- *What type of glass and ceramics do you use? (please state supplier if possible)*
- *What production methods do you use?*
- *What type of kiln(s) and what firing schedule(s) do you use?*
- *Do you use any other materials in your work or add any extra materials to your glass or ceramic bodies to make them more compatible?*
- *What is the style of your work – i.e. sculptural, functional, one off, limited edition or batch?*
- *What is the inspiration or intent of your work?*
- *Where can examples of your work be found?*
- *Has your work been published, if so where?*
- *Do you know of other artists working in this way?*

These questions were to gain more in depth knowledge about the artist's studio practice and the dissemination of their work. The information that was collated is discussed below in each case study; additionally each artist's questionnaire can be referred to individually (see Appendix 14).

5.3 Case Studies

5.3.1 Case Study 1: Nathan Anderson

Nathan Anderson is a US ceramicist who combines hot molten glass with his wheel thrown ceramics which he calls 'Glasku'. He works the materials in a hot state; which relates to *Process Route 4*: The combination of a (high fired) ceramic with hot glass (see section 3.4.4). He works in a stoneware Raku clay body from *Continental Clay;* which he hand throws, biscuit fires and then glazes and high fires in reduction. He then heats the piece up and wraps hot glass trails around the vessels; working with Michael Boyd of Foci Glass, in Minneapolis Minnesota to achieve this process. He first started to work in both materials in 2002, when he added recycled glass to glaze and melted it in a raku firing. His current method was developed in 2005 at Steven Branfman's workshop. [74] He studied under Kristi Downing at the KKD Pottery; he has also attended several work shops run by Wally Asselberghs, Linda and Charlie Riggs and Kate and Will Jacobson.

Figure 178 Anderson, 2005, Glasku, Raku fired ceramic, bronze glaze & hot glass trail

The case study questions were used to unpick Anderson's approach and to gain a deeper understanding of his practice (see Appendix 14); his answers below indicate that the challenge of combining the two materials and the effects that he creates are the main inspiration behind his work:

Why do you combine glass and ceramics in your work?
I like the challenge of the process as well as the final visual effect.

What is the inspiration or intent of your work?
I am fascinated by the effects I get from this combination of Hot Glass and Raku.

[74] I first came across Anderson's work through contact with US ceramicist Steven Branfman.

It is apparent that his approach is closely aligned to the tests produced in Process Route 4Bi (see appendix 5), however his stoneware vessels were more suitable than the fine unglazed porcelain core that was used in Test 4Bi (see Figure 84); which severely cracked when it came into contact with the hot glass. Although some surface cracking is visible in the glass trails of his work it has not cracked the ceramic (see Figure ***178*** & Figure 179). Anderson has demonstrated that this process route can be achieved if a thicker vessel is used.

Figure 179 Anderson, 2005, Glasku, Raku fired ceramic, red glaze and hot glass trail

5.3.2 Case Study 2: David Binns

David Binns is an English ceramicist; he adds recycled glass to his composite mix of mineral aggregates, which he fires into large scale sculptures. He works the materials in a hot state, which relates to *Process Route 3*: The combination of kiln cast glass and (high) fired ceramic (see section 3.4.3). Binns packs a mould containing the mix of aggregate and glass which is placed in a kiln and fired to around 1200˚C. The glass materials on heating melt and flow between the particles of aggregate material. On cooling the glass solidifies, giving a solid matrix of aggregate and glass material. [75] His work is made almost entirely from recycled waste material.

Binns completed his BA in *3D Design* in 1982 at the Manchester Polytechnic which he specialised in wood, metal and ceramics. Prior to using glass, his work was made only with ceramic based materials. He first introduced glass into his work in 2004 (see Figure 181), although he carried out some earlier experimental tests whilst on a residency in 2000, at the International Ceramics Studio in Kecskemet, Hungary.

Figure 180 Binns, 2005, Ceramic aggregates and recycled glass, 47 x 47 x 7cm

Figure 181 Binns, 2004, Testing aggregate & glass mixtures

[75] I first met Binns in 2006 at the *Atoms to Art* Research Conference, where we both presented and I was able to experience Binns work first hand as he brought along some examples of his work. He also attended the *Parallels and Connections: A research student Conference* at the University of Sunderland in 2007, where we were able to further develop this case study.

Binns has recently developed a series of work that fuses together purely clay components with glass/ceramic components to give a sharp delineation between the two contrasting materials within a single artwork.[76]

Of the case study questions that were used to elucidate Binns' approach, his answers below indicate the similarities apparent in the two materials and the visual qualities that he creates directly in his work. In his use of grinding and polishing techniques parallels can be seen between his work and this research project. His approach is similar to the diamond cutting techniques which were used to cut back and reveal the translucent areas in ceramic forms of the *Balanced* & *Torn* artworks (see section 4.2, 4.3 & 4.8) and the *Flint, Spear, Shell & Skim* artworks (see section 4.6).

What similarities or links have you experienced in the working of glass and ceramics in your work?

The process of grinding and polishing has long been part of the glass maker's repertoire. I have 'borrowed' this process and applied it to my ceramic work – a process until recently rarely used by ceramic makers.

Do you think that there are any particular aesthetics associated with combining glass and ceramics?

My approach has been to combine them in granular form. This has created I think a unique aesthetic, you don't get a completely opaque clay surface and you can't achieve a fully translucent material – the aesthetic qualities are unique – a surface that has a greater visual depth – depending on the ratio of glass with ceramic material. What I like is the fact that what is seen on the surface, passes through the core of the entire piece.

It is apparent that his approach is closest to the tests produced in Process Route 3A - 3C (see appendix 5); no visible stresses or cracks can be seen in his work (see Figure 180 & Figure 180). Binns has demonstrated that this process route can be achieved if the materials are used in fine granular form with varied ratios of glass frit and ceramic aggregate. In comparing Binn's artworks to my own work that the visual style is quite different however the approach and thinking is similar. In the *Translucence* artworks (see section

[76] More information can be found out about his work on his website at (www.davidbinnsceramics .com).

4.3) and the *Emergence* series (see section 4.9) fine grains of glass frit have been fused together with porcelain and bone china (high fired) aggregates; which have a similar surface texture to Binns. However the ratios that the materials are mixed in are very different.[77] My work resembles a pâte de verre kiln cast core which is quite fragile set within an aperture of a separate glass form. Whereas, Binns' artworks are far stronger, densely packed and fired just once as a single form with the same porous appearance throughout.

Figure 182 Binns, 2005, Ceramic aggregates and recycled glass

[77] As I use a higher glass content and Binns' uses a higher ceramic content.

5.3.3 Case Study 3: Steven Branfman

Steven Branfman is an American ceramicist; he has developed an inlaid technique that involves pressing glass chips into the sides of wet hand thrown stoneware vessels which are then raku fired, he works the materials in a hot state which relates to *Process Route 1*: The combination of (green state) ceramic with glass frit (see section 3.4.1). He uses stoneware clay from *Laguna Clay*, which he combines with coloured glass.

Figure 183 Branfman, 2002, Rolling the thrown vessel in coloured glass chips, paddling the vessel and forming the thrown vessel from the inside out (left to right)

His vessels are thrown as cylinders, he then arranges the crushed glass on a table in patterns noting colour, tone, contrast and size; he then rolls the wet cylindrical form on to the glass. The wet clay picks up the glass. He then paddles the glass to press it into the surface, which is repeated until the right amount of glass and pattern is achieved. The cylinder is then placed back on the wheel and the vessel is formed from the bottom up and inside out without touching the surface of the form.[78] By expanding the form the surface becomes stretched which creates interplay between the inlaid glass and the form of the vessel (see Figure 183).

Branfman first started working both glass and ceramics in 1996, inspired by the similarities between glass and ceramic glazes he devised a way to combine them in his work. He studied at the *Rhode Island School of Design*, in 1975 and completed his BA at *Cortland State University*; he regularly teaches workshops at his studio and many of his students have gone onto incorporate his techniques in their work, including Anderson (see section 5.3.1). Of the case

[78] If Brafman touched the outside surface of the form the glass would cut his hands.

study questions that were posed to Branfman, his answers below indicate his reasons for using glass and the final style that he strives for in his work:

What similarities or links have you experienced in the working of glass and ceramics in your work?

I use the glass for color and texture. My method involves the inlaying of crushed glass into the surface of wet clay. While there is a recognizable similarity between the melted glass and traditional ceramic glaze, ironically it is the dissimilar nature of the materials that result in the surfaces that I work to achieve.

Do you think that there are any particular aesthetics associated with combining glass and ceramics?

My vessels are all about aesthetics; form, shape, volume, presence, and how the surface defines these characteristics. My surfaces are not canvases upon which to decorate. My surfaces are "skins" that define the inner volume and pressure. The glass inlays work to help in this definition and statement.

It is apparent that his approach is closest to the tests produced in Process Route 1A – 1B (see appendix 5); no visible stresses or cracks can be seen in his work (see Figure 184). Branfman has demonstrated that this process route can be achieved if the materials are combined in the wet state, using small chips of glass. In comparing Branfman's artworks to my own, the visual style is quite different as are our approaches. I decided not to further investigate this route in my final artworks as the result was not what I wanted to achieve; however it was extremely useful to understand Branfman's approach and to be able to document it within this case study. His work has a wide appeal to others in the field, which is evident in the workshops he teaches using this technique

Figure 184 Branfman, 2002, Thrown stoneware vessel, inlaid with coloured glass chips & brushed white raku glaze, 31cm

5.3.4 Case Study 4: Edmeé Delsol

Edmeé Delsol is a French artist who combines kiln cast glass and raku fired ceramics in a cold state. Although her work does not relate to a Process Route, her approach was deemed significant to this research project. She uses optical crystal from Corning and ceramic from *Céradel* which she mixes with local natural ceramics; she also sometimes adds grogs, and vermiculite to the ceramic and coloured stains. She hand forms the glass form first in glass and then creates a plaster mould in which to cast the glass, the ceramics are hand built.

Figure 185 Delsol, 2009, Kiln cast glass and raku fired ceramic

She studied painting at the *Ecole Nationale Supérieure des Beaux Arts* de Paris from 1963 -1967 and started working in ceramics in 1980; she first started to combine glass and ceramics in 1990. She is an established artist, her work is featured in many important French collections including the *Musée des Arts Décoratif,* in Paris*, the Musée du Verre, in Sars Poteries* and the *Musée de Sèvres,* in Sèvres. In answer to the case study questions that were set to Delsol, her reasons for using glass and the inspiration for her work were the most informative of her approach:

Why do you combine glass and ceramics in your work?

The mineral composition of the ceramic, enamel and glass, a ceramic can be vitrified, the 2 both pass by fire. The correspondences and contrasts; glass can be the continuity of the ceramic. The way 2 matters engage interests me, between the density and clarity.

What is the inspiration or intent of your work?

Passages, nature and architecture which touch me, life and death, here and elsewhere. The void and the space, the ambiguity of the glass.

It is apparent that her approach is outside the parameters of this research project as she combines the materials in a cold state; however the visual qualities of her work have been of particular interest; her work examines the oppositions between the transparency and opacity of the materials (see Figure 183 & Figure 184). This theme has been used in the creation of artworks, in relation to the *Translucence* (see section 4.3) and *Emergence* series (see section 4.9) of artworks; which display this visual connection in their form and surfaces.

Figure 186 Delsol, 2009, Kiln cast glass and raku fired ceramic

5.3.5 Case Study 5: Etsuko Tashima

Etsuko Tashima is a Japanese artist who combines cast glass and ceramics in a cold state. Tashima's work does not relate to a process route, however like Delsol her approach was deemed significant to this research project. She uses glass from the *Santoku Co* and ceramics from *Kaneri*, in Sigaraki. She slab builds her ceramic elements and kiln casts the glass in moulds; she then glues the elements together (see Figure 188).

Figure 187 Tashima, 2003, Cornucopia 03-I*, kiln cast glass and slab built ceramic,* 85 x 53 x 63cm

She studied ceramics at the *Osaka University of Arts* and started to combine both glass and ceramics in 1992. She is an established artist and has had many national and international exhibitions. Of the case study questions that were posed to illuminate Tashima's approach, her answers below indicate the visual links between glass and ceramics and the inspiration for her work:

Do you think that there are any particular aesthetics associated with combining glass and ceramics?

The point I want to emphasize is harmonisation between two distinctive materials that has contrastive characters e.g. ceramics and glass. I feel an energy from lights coming through transparent glass. On the other hand, ceramics can not pass through light. However, I feel warmth from a texture of ceramics including smells of soil and under glaze with a good glass.

What is the inspiration or intent of your work?

Basically, beauty of nature, especially the form of plants and their colour variations, and hopefully would like to express the richness and happiness that is able to get from all harvests in nature. I see plants as strength of nature and how feminine they are like. For this reason, I put the title called 'Cornucopia' on my exhibits, which means goddess (Venus?) or feminine in Greek.

It is apparent that her approach is also outside the parameters of this research project as she (like Delsol) combines the materials in a cold state; however the visual qualities of her work are of significance to this research. She examines the differences between glass and ceramics, using strong contrasts between glossy opaque surface of the glass and the matt, unglazed ceramic form. Her work has been influential to the final visual style of my artworks and it has been important to refer to other artists working in cast glass, as a precedent for the later series of work such as *Spliced*, *Segment* and *Wedge* (see section 4.11 & 4.12).

Figure 188 Tashima, 1999, 'Corn*ucopia 99-VII*', *kiln cast glass and slab built ceramic, 50 x 54 x 60cm*

5.3.6 Case Study 6: Jean Fontaine

Jean Fontaine is a French ceramicist; he creates sculptural creatures in stoneware ceramics which he combines with blown glass elements in a cold state. Fontaine's work does not relate to a Process Route, however (as previously discussed) like other artists working in a cold state his artistic approach was important to this research project. He uses furnace glass and ceramic from *Saint Amand* to which he adds grog and porcelain slip additions, he also incorporates metal parts such as insulators into his work. He uses several different techniques including moulding, casting, extrusion and hand modelling to create the main ceramic elements to which he adds the glass elements in a cold state (see Figure 189 & Figure 190).

Figure 189 Fontaine, 2009, blown glass and hand built ceramic, with a white plume

He studied for his *Licence Arts Plastiques* at the *Sorbonne,* in Paris, in 1974 and went on to the *National des Beaux Arts*, in Macon in 1975. He started combining glass and ceramics in his practice in 1990. Of the case study questions that were posed to Fontaine, the following answers revealed the artistic intention of his work and why he combines glass and ceramics in his practice:

Why do you combine glass and ceramics in your work?

My work is mainly founded on contrasts: black and white, parts human (and/or animal) and mechanical….. Moreover glass and ceramics are two materials which "get along" well, they are both of materials transformed by fire, and they thus have the same history.

What is the inspiration or intent of your work?

My intention is to bring closer man and machines, the machines are our children of which we cannot pass to us any more… to demystify our bodies of which we polish the appearance but of which the interior is also only mechanical, mechanics which is repaired, changed, is replaced by true machines… I sail between fascination and rejection of this often uncontrolled technicality.

His approach is also outside the parameters of this research project as he (like Delsol and Tashima) combines the materials in a cold state; however the artistic intention and visual qualities of his work are of importance to this research project. He also explores the contrasts of glass and ceramics in his work; the glossy transparent nature of glass is offset by the dense matt surface of his ceramic forms. This approach has influenced the final visual style of my artworks.

Figure 190 Fontaine, 2009, blown glass and hand built ceramic

5.3.7 Case Study 7: Kristin Gudjonsdottir

Kristin Gudjonsdottir is an Icelandic artist working in America she creates mixed media abstract sculptures in cast glass, ceramic, metal and stone, assembled in a cold state.[79] Gudjonsdottir's work does not relate to a Process Route, however (as previously discussed) like other artists working in a cold state her artistic approach was central to this research project. She uses kiln cast glass and ceramic, which she creates using several different techniques; including casting and hand building to create the glass and ceramic elements which she combines using glue (see Figure 191 & Figure 192).

She studied at the *Iceland Academy of the Arts* from 1991-1995 and went onto complete her BFA in Sculpture and glass from *California College of the Arts*. She first started to work in both materials in 1993. In answer to the case study questions that were set to Gudjonsdottir, her reasons for using glass and the similarities that she had experienced in working in both glass and ceramics; were the most informative and revealed different aspects of her approach:

Figure 191 Gudjonsdottir, 2002, 'Seekers in line' kiln cast glass & hand built ceramic, 50cm

Why do you combine glass and ceramics in your work?

Because these materials look good together and can easily be manipulated to work together.

What similarities or links have you experienced in the working of glass and ceramics in your work?

Both can take high heat without blowing up. I can fire in the same kiln at the same time cast glass as I am firing a ceramic piece. I can slump a glass piece easily on a clay piece in the kiln without anything breaking. Using kiln wash in between just to be safe. Similar in the respect that glass likes to stick to clay as in glazes so why not have clay on the surface of glass. Some clay types seem to have a similar contraction when cooling as clay so great to

[79] I first came across Gudjonsdottir's work when she was involved with the *Institute for Research in Glass* (IIRG), at the University of Sunderland.

cast together or to create molds that have a hole in them like making a glass circle using clay as the mold material.

It is apparent that Gudjonsdottir's approach is also outside the parameters of this research project as she (like Delsol, Tashima and Fontaine) combines the materials in a cold state; however her approach is of significance to the research. In her work she investigates the disparity between the transparent surface of the glass and the dense ceramic body; which she assembles to create her sculptural artworks; this approach has influenced the final style of my artworks.

Figure 192 Gudjonsdottir, 1999, 'Multi cone' cast glass & hand built ceramic, 33 x 23 x 23cm

5.3.8 Case Study 8: Amy Lemaire

Amy Lemaire is an American ceramicist and glass bead maker, she uses bead making techniques to fuse soda lime glass beads to her high alumina stoneware ceramic forms (see Figure 193 & Figure 194). She works the materials in a hot state; which relates to *Process Route 4*: The combination of a (high fired) ceramic with hot glass (see section 3.4.4).

Figure 193 Lemaire, 2004, 'Bead Pod' Soda-fired clay bead with lampworked, soda-lime glass accents

She works in a high alumina clay, *'Lillstreet Special'* from *Continental Clay;* which she hand builds, biscuit fires and glaze fires in a soda kiln. The ceramic elements are then fired a third time in an electric kiln, and pulled out at the peak of the firing. The glass is then added in the flame using lampworking techniques, annealed and slowly cooled. The glass she uses is borosilicate and is mainly sourced from the *Northstar* and *Glass Alchemy* ranges from *Frantz Art Glass*. She often incorporates other materials: found wood, silver, encaustic, brass, and live plant matter to create her final pieces.

Figure 194 Lemaire, 2005, 'Pod Group', Soda-fired clay beads with lampworked, soda-lime glass, 5x5x4cm

She completed her BFA in Ceramics at the *School of the Art Institute of Chicago* in 2000 and in 1999; she went to the *Glasgow School of Art* as an exchange student. She is due to complete her MFA at the *Pratt Institute*, in New York in 2010. She first started to combine glass with her ceramic work in 2004. In response to the case study questions that were posed to further understand Lemaire's approach, she indicates below the links and visual qualities she has experienced in working in both glass and ceramics; which were of particular interest:

What similarities or links have you experienced in the working of glass and ceramics in your work?

While researching glaze chemistry and glass chemistry, I was struck by the similarities in chemical makeup, and that some information (specifically, how to adjust the COE of a glass or glaze, tinting colors of glass/glaze) crossed over from glass to clay or vice versa.

Do you think that there are any particular aesthetics associated with combining glass and ceramics?

Glass, when used in combination with clay often takes on "wet" qualities, while the clay seems "dry". It seems that the liquidity or fluidity of glass is emphasized. Of course, this is based only on what few pieces I have seen which combine glass/clay.

It is apparent that her approach is closest to the tests produced in Process Route 4Bi (see appendix 5), however (as previously discussed in relation to Anderson's work) her stoneware vessels are far more suitable then the fine unglazed porcelain core that was used in Test 4Bi which cracked (see Figure 84). No surface cracking is visible in the glass beads of her work (see Figure 195), Lemaire has demonstrated that this process route can be achieved. As previously discussed in reference to Anderson (see section 5.3.1), I decided not to further investigate this route in my final artworks as the final result was not what I wanted to achieve; also I am not proficient in lampworking techniques.

What is of particular interest with this technique is that Lemaire has used specialist glass bead making techniques to extend her ceramic practice. This crossover in techniques is of a similar philosophy to this research project, which intentionally uses techniques from both glass and ceramics to achieve a desired visual style.

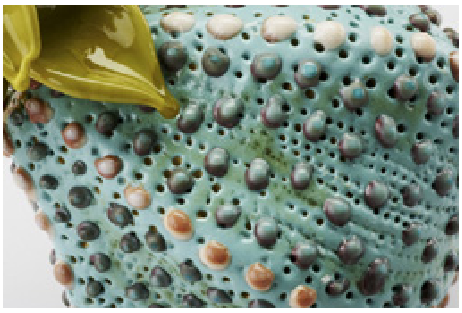


Figure 195 Lemaire, 2004, Detail shot of 'Bead Pod' Soda-fired clay bead with lampworked, soda-lime glass accents

5.3.9 Case Study 9: Jenny Mulcahy

Jenny Mulcahy is an Australian ceramicist; she combines hand built ceramics, bronze, glass and found objects which she assembles in a cold state. Mulcahy's work does not directly relate to a Process Route; however like other artists working in a cold state her artistic approach was significant to this research project. She uses kiln cast glass from *Blackwood Crystal* and a clay body which she mixes herself and to which she adds perlite (see Figure 196). She fires the glass in a mould made from a section of ceramic cut from the original sculpture to get an exact fit (see *Figure 197).*

In 2009, she completed her PhD in Creative Arts, at the *James Cook University*, Townsville, Queensland. Her research was concerned with developing a new clay body; she started to work in both materials in 2001. In 2006 had an exhibition entitled 'Sensing the silence' which was a significant component of her PhD research project.

Figure 196 Mulcahy, 2004, 'Inheritance' from Mary Kathleen Series 2, hand built ceramic cast glass & found objects

In response to the case study questions that were asked, Mulcahy states her reasons for using glass and ceramics and the inspiration for her work, her answers below were informative and revealed her approach in more detail:

Why do you combine glass and ceramics in your work?

I find it technically challenging and the contrast between the heavily textured ceramic surfaces and cast glass aesthetically pleasing.

What is the inspiration or intent of your work?

My work is mainly landscape-based. The glass components act as a metaphor for the earth's innate energy. My last major body of work was for my PhD and was exploring the visual interpretation of silence and focused on the landscape around a defunct uranium mine.

It is apparent that her approach is also outside the parameters of this research project as she (like Delsol, Tashima, Fontaine and Gudjonsdottir) combines the materials in a cold state; however the visual quialities of her work are of significance to this research. She uses bold contrasts between the glass and ceramics, to create her totemic and iconic sculptures which she states act as ‘sentinels to the land’. Her work has been influential to the final visual style of my artworks.

Figure 197 Mulcahy, 2004, ‘Blue Arch’ handbuilt ceramic & clear cast glass, 25x6x32cm

5.3.10 Case Study 10: Sally Anne Osborne

Sally Anne Osborne is an English ceramicist; she uses ceramics as a setter for small chips of coloured glass frit. She combines her work in a hot state which relates to *Process Route 2*: The combination of (high fired) ceramic setter with glass frit (see section 3.4.2). She uses mainly unglazed porcelain or bone china which she combines with glass frit from the furnace or sourced from *Warm Glass*.[80]

Figure 198 Osborne, 2005, series of tests combining ceramic setter with glass frit

She studied *Design and craft* at the *University of Staffordshire*, from which she graduated in 2006; she started to combine glass and ceramics in 2004 as part of her undergraduate degree, for which she created a series of tests (see Figure 198). In response to the case study questions that were posed to Osborne, her answers relating to the technical difficulties she had encountered as well as her motivation for working in both glass and ceramics; gave a practical insight into her work:

What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?

I spent nearly a year (at university) experimenting and gaining my limited understanding of how the two materials fill together and I learn every time I do a firing. The stresses the two forces excerpt on each other are enormous. I still have bowls that will just split in two for no apparent reason 6 months after I have made them.

Why do you combine glass and ceramics in your work?

I love the unpredictability of it! I am never completely sure what is going to come out of the kiln. There is something very rewarding (and frustrating) about not being able to have complete control over the materials. But you can get the most amazing results.

[80] I came across Osborne's work in 2006, at *New Designers*, the art and design fair for graduates.

It is apparent that her approach is closest to the tests produced in Process Route 2A-2D (see appendix 5); no surface cracking is visible in the surface of her work. Osborne has demonstrated that this process route can be achieved if the glass is used in fine granular form. In her artworks the frit has been lightly tack fused in a small area which reduces the amount of tension created throughout the ceramic plate (see Figure 199 & Figure 200). In comparing Osborne's artworks to my own work the visual aesthetic is quite similar as is the approach and thinking. In the *Torn* artworks (see section 4.3); the *Fragments* series (see section 4.5) and the *Flint, Spear, Shell & Skim* series (see section 4.6) fine grains of glass frit have been fused onto white ceramic setters. The use of small apertures is also quite similar to the *Emergence* and *Spliced, Segment* and *Wedg*e ranges (see section 4.9 - 4.12). These artworks do have a very similar appearance to Osborne's work; however more glass frit has been used and the surfaces have been diamond cut or sandblasted with decoration in these artworks.

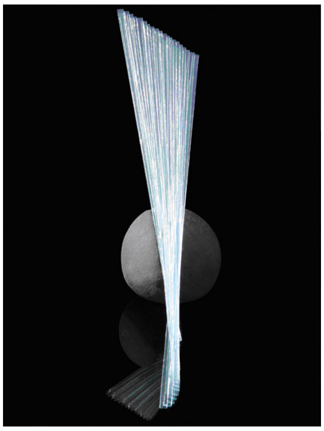
Figure 199 Osborne, 2006, Bone China Plate fused with green and clear glass frit

Other differences are apparent in that Osborne uses coloured frit whereas only clear frit has been used in the *Fragments* and *Flint, Spear, Shell & Skim* ranges. It has been of interest to this research project to work with an artist who has such an aligned approach. Osborne's work supports the visual aesthetic that has been developed throughout the research; which reveals that working with glass and ceramics (particularly using bone china or porcelain) produces similar results.

Figure 200 Osborne, 2006, Bone China Bowl fused with blue and clear glass frit

5.3.11 Case Study 11: Dave Roberts

Dave Roberts is an English artist, who works with float glass and black clay which he assembles in a cold state. Roberts' work does not directly relate to a Process Route, however (as previously discussed) like other artists working in a cold state his artistic approach was significant to this research project[81]. He uses 3mm sheet float glass which he cuts by hand and UV glues or kiln fuses, which he then combines with a hand built black clay body from *Scarva* Ceramics (see Figure 201 & Figure 202).



In 2009, he completed his BA in *Applied Arts* specialising in Ceramics Glass and Metals, at the *Plymouth School of Art*. He started to work in both materials as part of his degree in 2008. In response to the case study questions that were presented to Roberts, his answers relating to the similarities or links he has come across when working in both glass and ceramics and why he works in this way; gave an interesting viewpoint on his work:

Figure 201 Roberts, 2009, 3mm float glass U.V adhesive Black Scarva clay 30x10 x70cm

Why do you combine glass and ceramics in your work?

The multiple layers of 3mm float glass in the sculptures reflect and refract light. The use of a black clay body presents a powerful counterpoint to this interaction absorbing light as opposed to reflecting it. In addition the use of clay as a grounding material for the glass presented an opportunity to express the geometric origin of my work in fundamentally differing ways and yet still achieve a harmonic relationship between them.

What similarities or links have you experienced in the working of glass and ceramics in your work?

I developed a working practice which allowed me to utilise equipment traditionally associated with one material and exploited those potentials to develop aesthetic qualities within another. As an example the black scarva clay used in the ceramic forms could be linished after an earthenware firing to achieve a very smooth surface allowing a fine speckle to develop.

[81] I was first introduced to Roberts through his lecturer Sue McGillverary, who attended the Parallels *and Connections* Research Student Conference, in March 2009.

It is apparent that his approach is also outside the parameters of this research project as he (like Delsol, Tashima, Fontaine, Gudjonsdottir and Mulcahy) combines the materials in a cold state; however the visual qualities of his work are of significance to this research. He creates strong contrasts between the glass and ceramics, using the black clay body as a counterpoint and grounding material for the glass; which is transparent and catches the light. His work has been influential to the final visual style of my artworks.

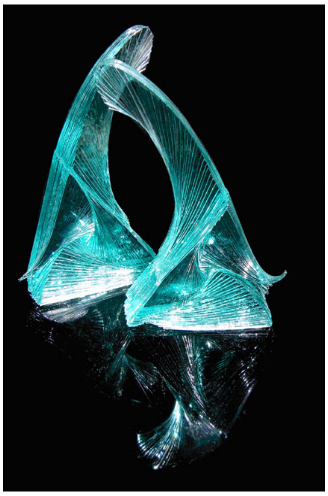


Figure 202 Roberts, 2009, Light Waves 3mm float glass kiln fused, 38 x 24 x 12cm

5.3.12 Case Study 12: Sally Resnik Rockriver

Sally Resnik Rockriver is an American ceramicist and glass artist; she creates chemical reactions in her blown glass and ceramic artworks and in her ceramic setters which she fused with glass frit. She combines her work in a hot state which relates to *Process Route 2*: The combination of (high fired) ceramic setter with glass frit (see section 3.4.2) and *Process Route 4*: The combination of a ceramic with hot glass (see section 3.4.4). She uses glass in sheet, billet and frit form from *System 96* from *Olympic Color Rods* and Cone 5-10 clay from *Bailey Ceramics* to which she adds various materials including 3110 Frit, oxides, zinc, silica, cryolite, potash, epk. She also uses sand, salt, soda and epoxy in her work. She uses ceramic materials that contain soda flux agents which are closely compatible to the glass. She has previously taught as Head of Ceramics at *Moorhead State University*, in Moorhead Minnesota. She received her MFA from *Hunter College*, a BFA from *UNC-Chapel Hill*, and has studied Glass and Ceramics at the *Penland School of Crafts* and *Corning Museum of Glass*.

Figure 203 Resnik Rockriver, 2002, Flower Geyser Calcite Formations on ceramics

She currently runs the *Resnik Thermal Lab*[82] in North Carolina and positions her work at the intersection of art and science. She first started to use glass frit on her ceramic forms in 1993, she then started blowing glass in 1996; applying ceramic glazes to hot blown glass forms. In response to the following case study questions, Resnik Rockriver gave a practical insight into some of the challenges she has encountered in her work related to the technical difficulties of working in glass and ceramics and the motivation behind her work, see below:

[82] More information on Resnik Rockriver can be found on her website at (http://www.thermallab.com)

What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?

The different coefficients of expansion/contraction has proven challenging. These limitations have dictated much of my process and aesthetic. There is a greater tendency toward cracking, and each new combination requires research.

Why do you combine glass and ceramics in your work?

I am making geological formations that occur at the intersection of hot glass and ceramic materials. In order to create the planetary surfaces and chemical reactions I must work with these elements at these temperatures.

It is apparent that her approach is closest to the tests produced in Process Route 2A-2D and Process Route 4F-4G (see appendix 5), no surface cracking is visible in the surface of her work (see Figure 203 & Figure 204). Resnik Rockriver has demonstrated that these process routes can be achieved if (in the case of Route 2) the glass is used in fine granular form mixed with a glaze fired onto a ceramic setter (in the case of Route 4) or the ceramic material is used in a glaze form within a hot glass form.

Figure 204 Resnik Rockriver (2009) 'Flood's Birthsite', Blown glass and ceramic glaze materials, 40.5 x 116.5 x 51cm

In comparing Resnik Rockriver's artworks to my own work the visual style is quite different however the approach and thinking is similar. In the *Torn* artworks (see section 4.3), the *Fragments* series (see section 4.5) and the *Flint, Spear, Shell & Skim* series (see section 4.6) fine grains of glass frit have been fused onto ceramic setters which is comparable to Resnik Rockriver's approach. Differences are apparent in that Resnik Rockriver uses coloured crystalline glazes and hand built ceramic forms (see Figure 203). Her blown glass work (see Figure 202) is quite different to the tests that were created in Process Route 4F -4G; however it is of significance to the research to understand her practical approach and the way that her work has developed. It has been of significant interest to the research to work with an artist that has such an aligned technical approach. Resnik Rockriver's work has influenced the technical approach that has been developed throughout this research project.

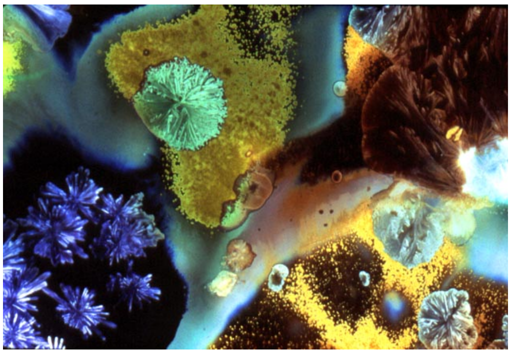


Figure 205 Resnik Rockriver, 1993, crystalline glaze materials & ceramics

5.3.13 Case Study 13: Alfred Spivack

Alfred Spivack is an American ceramicist; he has developed a technique which fuses sheet dichroic glass to high fired thrown stoneware vessels, which are usually glazed or stained. He combines his work in a hot state which relates to *Process Route 2*: The combination of (high fired) ceramic setter with glass frit (see section 3.4.2). His stoneware ceramics come from *Laguna Clays*, including *Babu porcelain, B mix, Red 9-11 and Soldate 60* which he combines with sheet glass frit from *Bullseye* glass, in a variety of finishes: opaque, translucent, lustre and dichroic surfaces.

Figure 206 Spivack, 2009, Butterfly Plate, Bronze stained plate and opaque & diachroic glass

Spivack is a trained clinical practitioner and medical researcher; he first began his ceramic studies in 1989 and has continued to attend workshops, run by Rory Nakata. He has attended Ceramic workshops at the *Alfred State University of New York* since 1999; he first started to combine glass and ceramics in 2000.

Figure 207 Spivack, 2009, Detail of Butterfly Plate, Bronze stained plate and opaque & diachroic glass

In response to the case study questions, Spivack provided an interesting viewpoint into some of the similarities he has encountered in working in both glass and ceramics and why he combines them in his work:

Why do you combine glass and ceramics in your work?

I felt that the beauty of both media could enhance each other. Some of the basic elements are common to both clay and glass. Although told by the "experts" that the properties of the two were hostile and that the combination would not work, it presented a challenge to create new forms of beauty and leave a small footprint in "The Road Not Taken".

What similarities or links have you experienced in the working of glass and ceramics in your work?

The basic chemistry of clay and glazes in itself suggests that there should be a probably combination. The temperatures for vitrification of clay and for the preservation of the cut and designed forms of glass and for the preservation of the dichroic surface were the challenges.

It is apparent that his approach is closely aligned to the tests produced in Process Route 2A-2D (see appendix 5), some surface cracking is visible in the surface of some of his earlier work, however the form remains intact and the *crackle* effect is used to his advantage (see Figure 31). No cracking is visible in his more recent work (see Figure 204 - Figure 207), Spivack has demonstrated that these process routes can be achieved if the glass is used in thin sheet form and fired onto a stoneware ceramic setter. In comparing Spivack's artworks to my own work the visual style is quite different however the approach is in some aspects similar. In the *Torn* artworks (see section 4.3), the *Fragments* series (see section 4.5) and the *Flint, Spear, Shell & Skim* series (see section 4.6) fine grains of glass frit have been fused onto ceramic setters which is comparable to Spivack's approach (although he works with sheet glass not frit).Immediate differences are apparent in that Spivack uses coloured sheet glass fused onto hand thrown ceramic forms which are quite different to the tests and artworks that relate to Process Route 2.

Figure 208 Spivack, 2009, Birds Plate, Red glazed stoneware and diachroic glass

Spivack's work has been of significant importance to this research project in the appreciation of his practical approach and technical understanding of combining glass and ceramics. It has been of interest to the research to work with an artist that has an aligned approach.

Figure 209 Spivack, 2009, Fish Plate, Blue glazed stoneware plate and diachroic glass

5.3.14 Case Study 14: Ron Starr

Ron Starr is an American ceramicist and glass artist, who works with blown glass elements and stoneware sculptures, which he assembles in a cold state. Starr's work does not directly relate to a Process Route, however (as previously discussed) like other artists working in a cold state his artistic approach was significant to this research project. He uses *Spectrum 96* furnace glass which he assembles with his hand built stoneware and terracotta ceramics from *Ceramic-A.R.T Clay* which he sets together using UV glue or assembles in juxtaposition (see Figure 210 & Figure 211).

Figure 210 Starr, 2004,' Fake Boob', Ceramic and glass

He studied ceramics at the *University of Wisconsin* from 1976-1980, he first started to use glass in his ceramic practice in 2004. In response to the following case study questions, Starr gave an interesting insight into some of the technical difficulties he has encountered in the working of glass and ceramics in a hot and cold state and why he works in both materials:

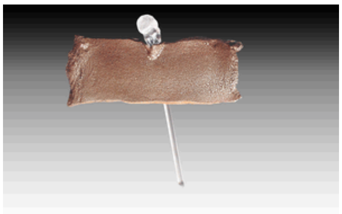


Figure 211 Starr, 2004, 'Spike', Ceramic and glass

Why do you combine glass and ceramics in your work?

I enjoy working with both materials. I like the flexibility and forgiveness of clay and its earthy appearance. While glass has very little forgiveness it presents the incredible brilliance. Finally, I also use the glass as an extension of glazing but in a chunkier more dimensional form.

What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?

When combined hot-crazing of the glass and cracking of the ceramic; none, when combined cold.

It is apparent that his approach is also outside the parameters of this research project as he (like some of the other artists discussed) combines the materials in a cold state; however his visual style and approach is of significance to this research project. He creates strong contrasts between his clear simple forms of glass and his raw, hand built ceramics, aligning the contrasting qualities of the materials in his work (see Figure 210 & Figure 211). His most recent work has focused on blown glass pieces without ceramic elements; however this work has a distinct ceramic style in the colouring and density of the surfaces (see Figure 212). His work has therefore been influential to the final visual qualities of my artworks.

Figure 212 Starr, 2009, 'U Log', Blown coloured Glass

5.3.15 Case Study 15: Claire Phillips Thomas

Claire Phillips Thomas is an English ceramicist, who works with earthenware slip and melted glass. She combines glass and ceramics in a hot state which relates to *Process Route 2*: The combination of (high fired) ceramic setter with glass frit (see section 3.4.2). She uses a white earthenware slip, mixed with paper pulp which she combines with sheet glass from *Bullseye and Warm Glass* (see Figure 34, Figure 213 & Figure 214).

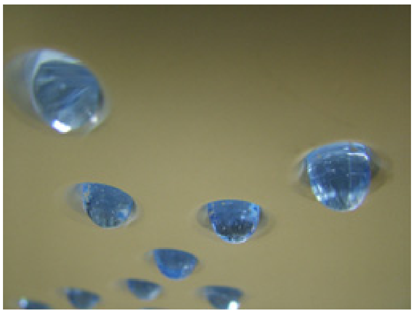


Figure 213 Thomas, 2009, Detail white earthenware and slumped glass

Phillips Thomas is a recent graduate from the *University of Cardiff* (UWIC), she developed a series of work that combines glass and ceramics for her recent degree show in 2009. She first started to combine both materials in 2008; she is currently studying towards her MA at UWIC. Her answers to the following case study questions give an interesting viewpoint into the motivation behind her work and some of the contrasts she has encountered in the working of glass and ceramics:

Why do you combine glass and ceramics in your work?

There is an initial sense of order and control during the process of working in ceramics, also in the preparation of working with glass which I enjoy. Yet, paradoxically the way in which I use glass, it has a freedom of its own, which I can't fully harness. I think this contrast or meeting of opposites is partly why I am drawn to working with both glass and ceramics.

What similarities or links have you experienced in the working of glass and ceramics in your work?

Generally for me I would say I have experienced opposites and contrasts as opposed to similarities when working with glass and ceramics, particularly when it comes to Kiln firing. I find that ceramic ware really doesn't like the way it is treated in a glass kiln once glass has been allowed to become almost molten on top of it. This has caused me lots of problems with the ceramic ware cracking as the glass cooled.

It is apparent that her approach is closely aligned to the tests produced in Process Route 2A-2D (see appendix 5), no surface cracking is visible in the surface of her work (see Figure 213). She has demonstrated that these process routes can be achieved if an earthenware slip, mixed with paper pulp is used with a flint glass. In comparing Phillips Thomas' artworks to my own work the approach is quite different; although the visual style of using an unglazed ceramic form against the glossy surface of glass is similar to the research. For example, in the *Fragments* series (see section 4.5) and the *Flint, Spear, Shell & Skim* series (see section 4.6) fine grains of glass frit have been fused onto ceramic setters. However, the main difference is that Phillips Thomas' uses coloured glasses which she slumps through pierced holes; this process is comparable to the *Balanced* series (see section 4.1 & 4.8) which has been diamond cut to create open holes. This link suggests a similar approach to the use of technique across the field of glass and ceramics.

Phillips Thomas' work is of importance to the research in order to appreciate her practical and technical approach to combining glass and ceramics. It has been of significant interest to this research project to work with an artist that has developed such an interesting approach; her artworks also draw parallels to the emerging visual qualities of the research.

Figure 214 Thomas, 2009, Detail white earthenware and slumped glass

5.3.16 Case Study 16: Andrea Walsh

Andrea Walsh is an English ceramicist; she works in unglazed bone china and kiln cast glass which she casts separately, and then heats together to get an exact fit, which she then assembles in a cold state. Walsh's work does not directly relate to a Process Route, however (as previously discussed) like other artists working in a cold state her artistic approach is significant to this research project. [83] She uses Bone china slip from *Valentines* and kiln casting glass from *Gaffer* and *Bullseye*. She uses glass elements to emulate water; creating a quiet, contemplative feeling of stillness and calm within her delicately slip cast work (see Figure 215 & Figure 217).

Figure 215 Walsh, 2007, 16 small bone china vessels with blue glass

She graduated from a Fine Arts degree in 1998 from the *University of Staffordshire*, she then went onto the *International Glass Centre*, in Dudley, and completed a Technical Course in glass in 2000. She completed her masters in Glass in 2002, at the *Edinburgh College of Art*. Walsh's answers to the following case study questions give an interesting insight into why she combines glass and ceramics in her work and some of the similarities she has encountered in the materials:

Why do you combine glass and ceramics in your work?

I am intrigued by materials; I explore the inherent qualities of both glass and ceramics in my work. Both have similar qualities echoed in each material which are complimentary. The alchemical qualities of the materials are also an intriguing process. Experimentation and discovery give me the passion to find out more.

What similarities or links have you experienced in the working of glass and ceramics in your work?

I have only ever worked in Bone china, as it has specific requirements that suit my working style – as large forms tend to have restrictions in scale. Similar processes and

[83] I met Andrea Walsh whilst studying for my Masters degree at Edinburgh College of Art in 2001.

characteristics of materials are echoed in each other. The distortion or movement present in both materials when fired as well as the transformation in the kiln are similar. Also the way hot glass flows is similar to bone china.

It is apparent that her approach is similar in terms of visual qualities, in her use of unglazed bone china combined with kiln cast glass elements. Parallels can be seen in the *Balanced* artworks (see section 4.1 & 4.8) where finely cast porcelain has been diamond cut, however fine grains of glass frit have been fused onto the surface; whereas Walsh juxtaposes her glass elements in a cold state (see Figure 216).

Figure 216 Walsh, 2009, Walsh in her studio, assembling a new piece of work

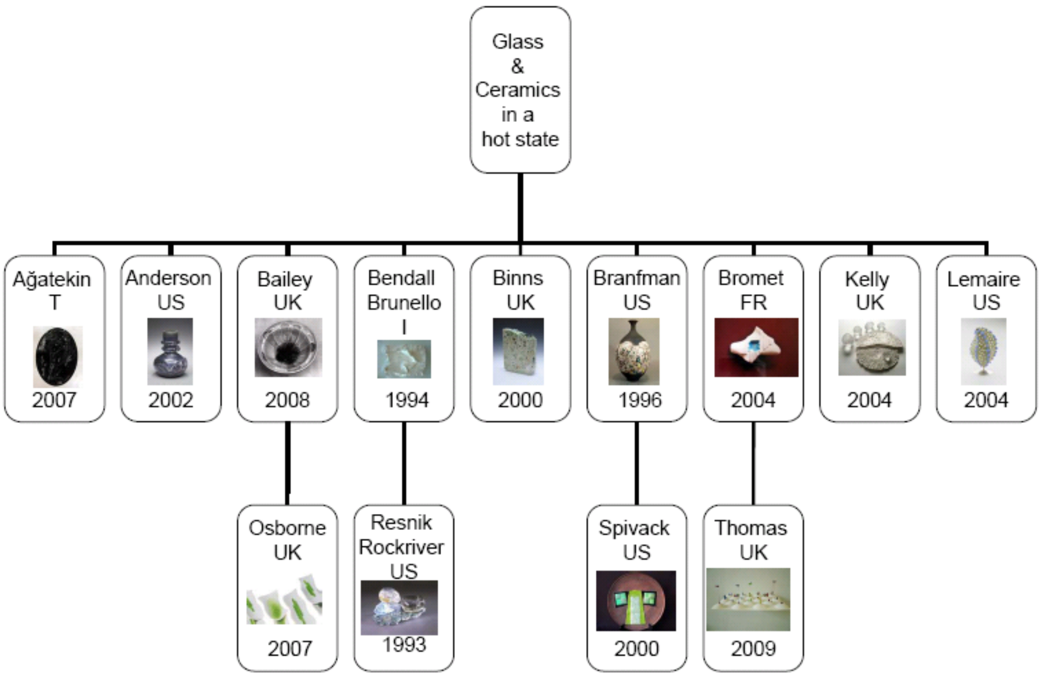
It has been of interest to the research to work with an artist that has a similar approach, in that Walsh exploits the contrasting state of unglazed ceramic and the highly polished, surface of glass as her artistic motivation. Walsh's artworks support the emerging visual style that has been developed throughout the research. It also demonstrates that the working of glass and ceramics (particularly using bone china or porcelain) can produce similar effects; which could to a certain extent be viewed as a collective style within the field.

Figure 217 Walsh, 2007, small and medium bone china funnel vessels with kiln cast glass

5.4 Overview of Case Studies

All of the artists that have been studied have influenced in some way the practical and visual qualities of combining glass and ceramics in studio practice. This collective of case studies adds to the debate surrounding the technical issues and visual style of this field; as proposed by this research project. An overview of the case studies is shown in a series of tables (see Table 8 - Table 11, Appendix 14); the data collated by the questionnaires was presented in this way to help to show similarities and differences between the artists. As well as helping to position the research findings, in relation to the work of these artists as previously discussed (see section 5.2). A series of visual maps were finally created to demonstrate which approaches the case study artists had employed in their artworks; in addition my artworks were included on the map to position my artworks within the field.

Table 8 Visual Map of Case study Artists that combine ceramics with glass in a hot state. [84]



[84] The dates refer to when the artists first started to work in both materials.

Table 9 **Visual Map of Case study Artists that combine kiln cast glass with ceramics in a cold state.**[85]

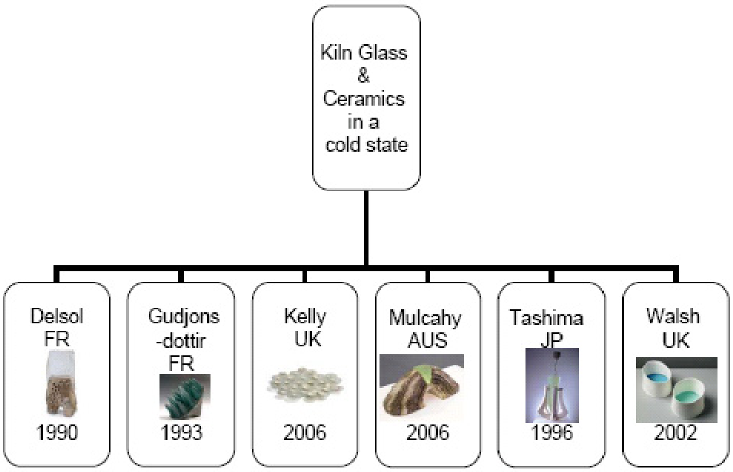
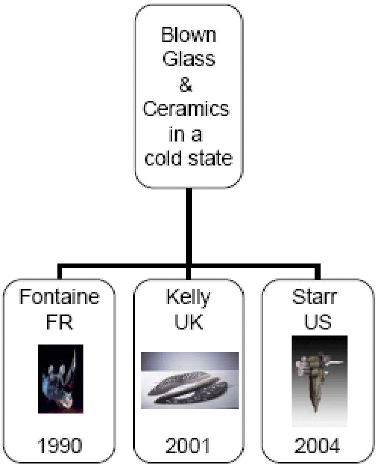
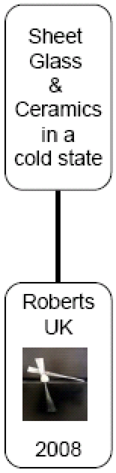


Table 10 **Visual map of Case study Artists that combine blown glass with ceramics in a cold state.**[86]



[85] The dates refer to when the artists first started to work in both materials.
[86] The dates refer to when the artists first started to work in both materials.

Table 11 Visual map of Case study Artists that combine sheet glass with ceramics in a cold state [87]



5.5 Additional Case studies related to a ceramic style in glassmaking

These case studies are focused on artists who have changed from ceramics to a glass practice, whilst retaining a ceramic style; with particular focus on the glass artists Paula Bartron and Criss Chaney. The questionnaire for these additional case studies was slightly different to the questionnaire sent to the artists working in both glass and ceramics and were focused on unpicking the artist's background and experience of ceramics and how this has affected their current glass work. Again, the same questions were asked to each artist to form a structure for the case studies, allowing comparisons to be made between the artists and establishing the parameters of this specific field (see Appendix 14).

The questionnaire had a brief introduction to the research and a request for information about their name, their area of discipline, and the materials that they use in their work and the training they have completed. This was then preceded by the following questions and a space for any additional comments:

[87] The dates refer to when the artists first started to work in both materials.

- *Have you ever combined glass & ceramics in your work?*
- *If so, when did you start to combine glass and ceramics in your work? (Please add date/year/image)*
- *What similarities or links have you experienced in the working of glass and ceramics in your work?*
- *Do you think that there are any particular aesthetics associated with combining glass and ceramics?*
- *Do you work mainly in glass but employ an aesthetic that could be seen as having a ceramic look or style?*
- *In regard to question 9, do you feel this has links to your training or your general approach to materials?*
- *Do you know of other artists working in this way?*

5.5.1 Case study 17: Paula Bartron

Paula Bartron was born in California and resides in Stockholm, Sweden, she completed her BA Design in Ceramics and Glass (1970) and an MA in Design in Glass (1972) under Marvin Lipofsky, at the *University of California* at Berkeley. In 1968, as a BA student she made some work using both glass and ceramics but she felt that they were unsuccessful; she decided thereafter to concentrate on just glass making.[88]

Bartron creates geometric sculptures that appear to be made of bricks or cylindrical vases that imitate ancient clay vessels (see Figure 218 & Figure 219). Her work is focused on unique and experimental works of art in glass with a distinct ceramic style. This is expressed through simple outlines and a restrained use of colour. Her work has a subtle translucence which is contrasted with the rough hewn surface of her work (Ricke, 1998, pp.24-29).

Figure 218 Bartron, 2008, Disk composites, sand cast glass, 40cm each

Bartron attended the *Orrefors Glass School*, in Sweden from 1973-74 and has worked as a glass apprentice and assistant in the US and Finland. She has had numerous solo showcases and group exhibitions throughout Scandinavia, Europe, the US and Japan. Her work is included in museum and public collections throughout the world particularly in Sweden. She started the studio glass program at *Konstfack University College of Arts, Crafts and Design* in 1975 where she is currently a Senior Lecturer. She has lectured at various symposiums and taught at workshops, most notably at *Pilchuck Glass School* and others in Europe, Japan & the US. In response to some of the case study questions that were presented to Bartron, she gave an interesting insight into the approach she uses and her previous combination of glass and ceramics as a student:

[88] I first met Paula Bartron at the *International Glass Symposium* in Novy Bor, in 2006 where I was able to see her work being made at the symposium which helped with my understanding of the style and intent of her work.

Do you work mainly in glass but employ an aesthetic that could be seen as having a ceramic look or style?

Ceramics is still there without being there. Much of the glass I make looks like clay, or has the feeling of clay. Some of the pieces are blown in sand moulds, deformed and covered with powdered glass, acid etched, etc. It is opaque or has the rough look of sand, clay, sometimes iron. The translucence shows when the work is lighted from the side. Other work is cast in sand, sawed, and fused into new forms and sometimes slumped. The sandy rough surface reminds me of clay.

Have you ever combined glass and ceramics in your work?

As a student I made some work using both materials that were unsuccessful. I realized that they were so similar that they fought each other for dominance in the work and neither won. I had used glass and a white-grey porcelain.

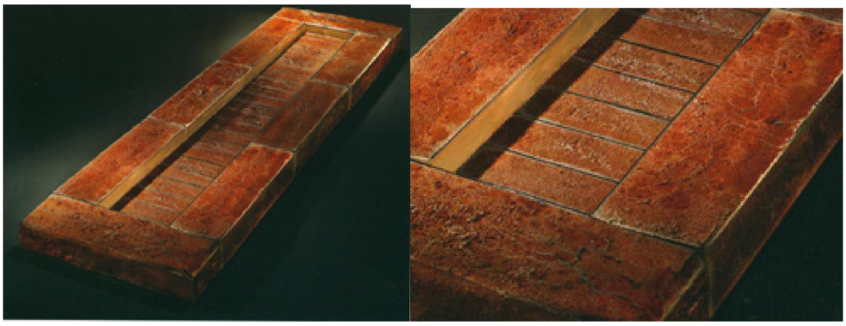


Figure 219 Bartron, 2008, Long White Basin, sand cast glass, 35 x 128 x 7 cm

She also affirms an initial feeling that was proposed at the start of the research about the studio glass movement, (see section 2.2.4) and which supports the suggestion that many glass artists were originally ceramicists who went on to create a distinct ceramic style in their work:

Many artists have had a ceramic look to their glass. Early on in the studio glass movement most people who got into glass came to it from ceramics. That is how it worked for me.

It is apparent that her approach is different as she does not combine glass and ceramics at all. However, her work is similar in terms of visual qualities in the use of white glass; especially in the case of the *White cylin*ders (see Figure 220). A similar visual approach can be seen in the *Displace* and *Wings* artworks (see section 4.4) which also do not combine any ceramics; choosing to imitate a ceramic style. Although not all of her work is carried out in white glass; some of her work is made in strong reds and oranges that resemble strong terracotta or earthenware clays or even brick (see Figure 217).

Figure 220 Bartron, 2004, Grey Cylinders, blown glass, 25cm

It has been of interest to the research to work with an artist who employs such a strong ceramic style within her approach. Bartron explores the contrasting state of glass by making a dense surface appear ambiguous (as if it is ceramics) by using a production method that encapsulates the soft distorted form of glass blowing to suggests something otherwise. Bartron's artworks add to the emerging visual qualities that have been developed throughout the research. It also demonstrates that the working of glass (particularly blown glass) can produce a distinct ceramic style.

5.5.2 Case study 18: Criss Chaney

Criss Chaney is a glass artist who works with blown glass to create work that has a distinct ceramic style. She began her studies at the *California College of the Arts* in San Francisco where she won a scholarship to study at the *Pilchuck Glass School*. She travelled over to the UK and completed her BA in Glass and Ceramics at the *University of Sunderland* in 2006. She currently works from her studio at the *National Glass Centre*, in Sunderland.[89] She specialises in combining metals with glass in her cast and blown glass work (see Figure 223); exploiting the optical properties of glass and the patination of metals; she creates unique sculptures that resemble ancient artefacts (see Figure 219 – 224).[90]

Figure 221 Chaney, 2006, Vessel Blown glass and enamels 16 x 12.5 x 10cm

Chaney is interested in developing texture by integrating non-glass materials into her work and exploiting techniques for working in both materials. Her work questions the perception of glass and examines the boundaries between glass and other materials. During her degree in 2005, she carried out some tests with ceramics and glass by incorporating her blown glass forms with wet ceramic slip, which she then ‘fired' in the glory hole (see Figure 222).

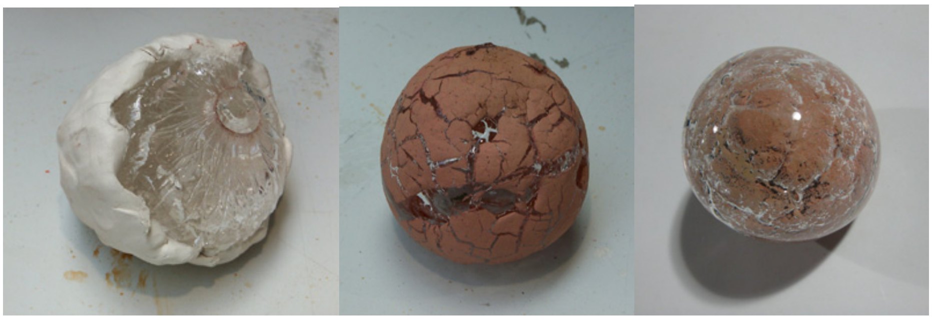


Figure 222 Chaney, 2005, Blown glass and ceramic slip test, porcelain & terracotta

[89] I first met Criss Chaney in 2004 whilst studying within the Glass & Ceramic Department at the University of Sunderland.
[90] More information can be found out about Chaney on her website (www.crisschaney.com).

In answer to the case study questions that were presented Chaney gave an interesting insight into her approach, describing the similarities she sees in glass and ceramics and the visual qualities she employs:

What similarities or links have you experienced in the working of glass and ceramics in your work?

When I was combining them I tried to think of ways to combine them that would use predominately glass techniques, but where glass and ceramic overlapped in terms of process. So for example I used blown glass and coated it with wet slip, then 'fired' it in the glory hole.

Do you think that there are any particular aesthetics associated with combining glass and ceramics?

In my own work I try to bring in the contrast between the natural, earthy, rough & opaque qualities of the ceramics with the smooth, sleek, modern, & transparent qualities of glass.

It is apparent that her approach is different as she does not combine glass and ceramics. However, her approach is of significance as she purposefully imitates a ceramic style within her blown glass forms. It has been of importance to the research to work with an artist who employs such a distinctive style within her work.

Figure 223 Chaney, 2006, 'Brass Couple's series Blown glass and brass enamels

Chaney's blown glass surface are coloured in bright reds and blues, or subtle golds and bronzes, set against a crackled and densely opaque surface. This ambiguous effect creates an interesting insight into her work and the motivation and influences behind her work. Chaney's artworks enhance and demonstrate the emerging visual qualities (linking glass and ceramics) that have been developed throughout the research; again demonstrating that the working of blown glass can be manipulated to create a distinct visual style often aligned with ceramics.

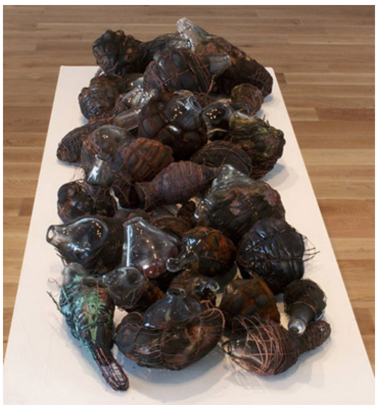


Figure 224 Chaney, 2006, 'Offerings' Blown glass, wire and enamels, 100 x 20 x 150cm

5.6 The approach to the collaborative projects

The first collaborative project came about when Professor Steve Dixon proposed a collaborative project as part of a '*Pairings'* scheme at the *Manchester Metropolitan University*. The second collaborative project developed from the relationship that was built up through the case study of Criss Chaney. As she wanted to know more about the potential of combining high fired ceramics within her blown glass practice, to extend the research she had started in her undergraduate degree. The approach of the collaborative projects was for the artists to respond to the potential routes process that had been developed and for new ideas and inspirations to be created in each others work. This would be used as a means of evaluating the research within the contemporary field of glass and ceramics.

5.7 Collaboration with Professor Steve Dixon

In March 2009, a collaborative project was set up with Professor Steve Dixon, who is a research fellow in ceramics at the *Manchester Metropolitan University*. Dixon mainly works in ceramics but became interested in working in both glass and ceramics when he attended the *Parallels and Connections:* Research Student Conference and heard about this research project. Dixon wanted to see if bone china flowers could be in some way incorporated with glass; the following tests were conducted Test 2G and Test 4G (see Material Testing Phase 2 Sheets: 2G & 4G, Appendix 5). This live project enabled the testing of *Process Route 2:* The combination of (high fired) ceramic setter with glass frit (see section 3.4.2) and *Process Route 4*: The combination of a (high fired) ceramic with hot glass (see section 3.4.4). We initially conducted a series of tests which related to *Process route 2* on some readymade bone china flowers (provided by Dixon) which were unglazed and high fired; these were then fused with three different types of frit and fired to two different temperatures (see Figure 225).[91] Several samples were created for Dixon who commented on the final colour and the fired qualities of the flowers.

[91] Dixon had been given these flowers from a ceramic Factory in Stoke on Trent where he was taking part in an artist in residency programme, as part of the Stoke Ceramic Bienale.

Figure 225 Dixon & Kelly, 2009, Flower tests Process Route 2Gi-2Gvi

A series of tests were then carried out relating to *Process route 4* on the readymade bone china flowers which were encapsulated in a variety of ways: encapsulated between hot cast layers of glass, picked up inside a hollow gather of blown glass and picked up inside a solid gather of blown glass. Visible cracks and stress could be seen in these tests which were incompatible and therefore not a stable series of tests (see Figure 226).

Figure 226 Dixon & Kelly, 2009, Flower tests Process Route 4Gi-4Giv (clockwise)

To overcome these compatibility issues, Dixon's bone china body was altered by adding quartz to the mix; this was then encapsulated within two layers of hot glass which created a compatible test without cracks or stresses (see Figure 225). Although the clay body was different to the Bone china previously tested (see section 3.8) it was possible to build on the research that had previously been carried out and create an improved clay body that matched the expansion rate of the studio glass.


Figure 227 Dixon & Kelly, 2009, Process Route 4: Test 4Gv

To realise this as a live project demonstrated that the potential process routes and methods developed were reliable and through ease of production were a repeatable process, which created consistency in terms of quantity and quality. After the tests had been completed, the potential creative possibilities of this research project were discussed with Dixon. The application of these techniques will be of significant use when the final collaborative project is realised in 2010, as part of the '*Pairings'* exhibition at the *Manchester Metropolitan University*.

5.8 Collaboration with Criss Chaney

In early 2009, an initial consultation was held with Chaney and she agreed to use some of the bone china clay body (with added quartz) in her blown glass work (see Figure 231). A series of works were created collaboratively in the glass blowing studio at the *University of Sunderland* (see Figure 228, Figure 229 & Figure 230) which encapsulated bone china within blown glass. A series of bone china inclusions and cores were created in a variety of shapes and sizes; which were high fired and then heated up in the pick up kiln. The ceramics were picked up and gathered onto a hollow blown glass form which was then shaped and blown out into bowl forms (see Figure 229). In the case of the ceramic core this was picked up and gathered onto a solid blown glass form which was then shaped and formed into a paperweight (see Figure 232).

Figure 228 Chaney & Kelly, 2009, Collaborative work being created in the studio, Gathering Blown glass and encapsulating Bone china inclusions

Figure 229 *Chaney& Kelly, 2009, Collaborative work being created in the studio, Opening up Blown glass and Bone china inclusions, torching and heating*

Figure 230 Chaney & Kelly, 2009, Collaborative work being created in the studio, Gathering Blown glass over Bone china core and shaping

Additional tests were created that incorporated a range of metal carbonates and oxides into the glass; to create different surface effects (see Figure 231). This was an interesting experiment as Chaney tends to use different metals in her work to create a range of finishes; it also demonstrates a crossover in practice in the use of carbonates and oxides (which are generally used to colour a glaze) to colour blown glass (see Process Route 4:Test 4Hi-4Hiv, Appendix 5).

Figure 231 Chaney & Kelly, 2009, Series of blown glass tests with bone china inclusions and added oxides: copper carbonate, copper oxide, iron oxide & red iron oxide Test 4Hi-4Hiv (left to right)

This collaborative project realised a new way of working and revealed the potential benefit of the potential processing routes for other practitioners. This project was related to *Process Route 4*: The combination of a (high fired) ceramic with hot glass (see section 3.4.4). After the work had been completed, we discussed and reflected upon the project and the benefits that this potential process route would have for Chaney's future work; which she claimed would significantly extend her range of options in combining ceramics into her blown glass work.

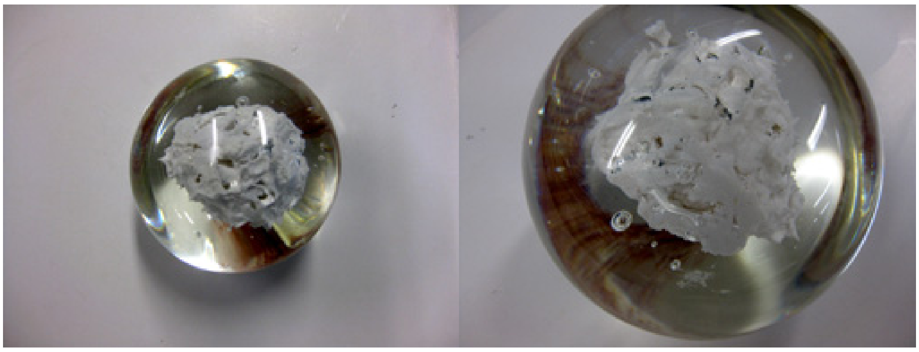


Figure 232 Chaney & Kelly, 2009, Collaborative project: Blown glass paperweight with bone china core

The final pieces created (see Figure 229 & Figure 230) were very different to the tests that were previously produced in the Material Testing Phases of this research project (see Process Route 4: Tests 4G, Appendix 5). Working with Chaney was an extremely useful experience, which provided a unique insight into her work; demonstrating the creative possibilities and benefits of Process Route 4. Future collaborative projects have been planned with Chaney to further investigate the creative possibilities of this process route.

5.9 Summary of case studies

This research has found many parallels and connections between the case studies which has influenced this project and in some cases resulted in collaborative work being undertaken. These projects have helped to realise the significance of the new process routes and to explore these routes in relation to the work of other practitioners in the field. This has helped to inform and influence some of the subsequent artworks which were created. These studies have aided the dissemination of the research and demonstrated that there may be a demand and application for the research findings within the field. This is exemplified by Chaney who has started to use the improved bone china body within her blown glass work; since embarking on this collaborative project. Working with the artists selected for the case studies has also created a series of useful contacts and connections; which can be developed further in the future into possible collaborative projects.

6. Conclusions

This chapter brings together the conclusions of the research and relates them to the aims and objectives identified at the outset of this project. The way that the research has impacted my own artistic practice is evaluated and the contribution to knowledge that the research offers. Possible areas for further research will be identified and discussed, followed by the final remarks of the research.

6.1 Conclusions relating to Aim and Objective 1

Objective 1 To identify and test possible potential process routes that combine glass and ceramics in a hot state.

Aim 1 To develop the practical and creative parameters of the combination of glass and ceramics in a hot state.

6.1.1 A range of new process routes

This research project set out to determine what potential process routes could be developed that combine glass and ceramics in a hot state. The aim was to develop a wide range of process routes that demonstrated the practical and creative parameters of the combination of glass and ceramics. A range of initial tests were carried out on four process routes, (see section 3.4) which displayed a variety of material properties and surface qualities from translucent and transparent, to matt and opaque, to shiny and smooth and cracked and crackled. The process routes investigated informed the research at an early stage and gave an informative insight into what could be achieved when combining glass and ceramics in a hot state. It also highlighted the need for further testing and compatibility tests to be carried out.

6.1.2 Compatibility Testing

As previously stated (see section 1.3), the main practical disadvantages associated with the combined processing of glass and ceramics in a hot state are:

- The structural differences of glass and ceramics related to their varying rates of expansion which creates incompatibility, in the form of excessive cracks or stresses in the combined body.
- The difficulty of controlling the process of partial conversion of either material into the other which would involve high refractory temperatures and specialised equipment.

To some extent the first issue has been partially resolved in that a series of compatibility tests were carried out which led to the development of a compatible Bone china body with added quartz which matched the expansion behaviour of the glass. With regards to the second issue, it was agreed at the outset of this research project that this would not be possible to achieve within a studio environment and was therefore considered outside the parameters of this research project.

6.2 Conclusions relating to Aim and Objective 2

Objective 2	To create a body of combined glass and ceramic tests and artworks.
Aim 2	To demonstrate and articulate the possible creative and practical benefits of the new processing routes as a model for practitioners in the field.

6.2.1 Demonstrating the possible benefits of the potential processing routes

The problems associated with combining glass and ceramics in a hot state were identified early on in the research (see section 1.3). The difficulties associated with the incompatibility of glass and ceramics when combined in a hot state were discovered (see section 3.3) and to some extents resolved in the compatibility testing (section 3.5) when a balanced system without excessive stresses or cracks was created. This significantly improved the quality of the tests, which could then be successfully applied to the artworks.

The range of potential processing routes developed may be of benefit to contemporary practitioners who wish to combine both glass and ceramics in their practice; as proven by the case studies and collaborative projects (see chapter 5). A range of artworks have been developed that demonstrate the creative potential of the new processing routes (see Chapter 4). Two main bodies of artworks were created; the first body of artworks were concerned with surface texture, related to an exploration of *Process Route 2: The combination of a ceramic setter with glass frit*. The second body of artworks were concerned with sculptural forms, related to an exploration of *Process Route 3: The combination of kiln cast glass with ceramic aggregate.* These artworks offered the opportunity to employ a wide range of methods of combining glass and ceramics – including slip casting, glassblowing, kiln casting, fusing and cold working techniques. This combination of various processing methods, draws attention to the crossovers in techniques that have been applied in the creation of new artworks.

6.2.2 Articulating the possible benefits of the potential processing routes

The research findings have been disseminated in a variety of ways as the research has progressed, as well as at its conclusions. Formal presentations have been given at a number of national and international conferences, including: the *Society of Glass Technology*, *Glass: The art of science* conference in 2006, the *Atoms to Art*: Research cluster conference in 2006 and 2007, the *Parallels & Connections*: Research student conference in 2007 and 2009. Research poster sessions and presentations have also been delivered more informally at Research Student forums at *Gray's School of Art*, in 2005 and at the *University of Sunderland*, in 2005. Linked with the *Society of Glass Technology* conference, an abstract for the research was featured on the society's website, which was an important way of presenting the research to a wider audience.[92] In addition, regular supervisory tutorials have provided the opportunity to discuss and present the research; sometimes involving group critiques with other PhD students. Expositions of the emerging tests and artworks were also held at the *Parallels & Connections*: Research student conferences.[93] The new artworks have been shown in a range of galleries and selected exhibitions supported by an

[92] For further information on this conference see: (http://www.glassartscience.co.uk/presentations.htm).
[93] The exposing of the research process, showcasing test alongside artworks.

artist's statement which discusses the intention of the work (see Appendix 12). This demonstrates that the artworks are of exhibition quality within the contemporary field and also explains the rationale behind this body of work. In developing and presenting the artworks in this manner it has been possible to professionally evaluate the outcomes of the research to a wider audience.

The benefits of the new processing routes and knowledge gained from the research project have also been shared with Criss Chaney and Professor Steve Dixon as a result of the collaborative studies (see Section 5.7 and Section 5.8). The creative potential of the research has been demonstrated through the artworks that were produced by these artists using the new processing routes in their practice. The input of these artists to the research and their interest in the creative potential of the findings is a sign of the benefit and value this research has for contemporary glass and ceramic practitioners. Additionally knowledge and advice has also been shared and transferred with the eighteen artists that were involved in the Case studies in Chapter 5 (Section 5.3).

Throughout the research the various methods of dissemination has resulted in a range of feedback being given on the research, from a variety of different perspectives. Input has been given from case study artists, gallery owners and curators and selectors of exhibitions, the supervisory team and the opinions of peers and delegates attending the conferences and student forums; all of which has helped to position this research project within the field. Finally, this published thesis will be an important way of disseminating the research, as it articulates the outcome of this research project in an accessible and permanent way. A digital copy of the thesis has been sent out to the artists that participated in the case studies and it is hoped that this will provoke further interest in the research and lead to further collaborations in the future.

6.2.3 The research as a model for practitioners in the field

The incompatibility issues with the hot state combination of glass and ceramics, discussed in the introductory chapter (Section 1.3), identified significant gaps in knowledge which suggested the need for a model of practice that could be transferred and used by others in the field. The following sections discuss the benefits of the new process routes as a model for others in the field.

6.2.4 Importance of the testing in the model of investigation

The material testing that was carried out (see Chapter 3) has been extremely useful in demonstrating the creative parameters of the potential process routes. The testing that has been documented has led to a greater understanding of the process routes and the possible creative applications of these routes as a model for others in the field. It was also an important way of working through the research problems in a systematic and empirical way.

6.2.5 Importance of the Artworks in the model of investigation

The development and creation of artworks that explore the creative potential of combining glass and ceramics in my own practice is the final stage of demonstrating this project research as a model for others. The resolved body of artworks that have been presented in various selected exhibitions and galleries indicates that the potential process routes (realised in the form of artworks) have been seen in a gallery setting and evaluated by others in the field. The process of integrating new process routes into one's art practice that combine glass and ceramics can therefore be achieved by following the model presented in this research project.

6.3 Conclusions relating to Aim and Objective 3

Objective 3 To create reference points by mapping the links between glass and ceramics to aid the positioning of the research within the field of studio glass and ceramics.

Aim 3 To articulate the significance of the research methods and results through the mapping of the field.

6.3.1 Articulating the significance of the research methods and results

In the Contextual Review (see Chapter 2), the field of glass and ceramics was mapped and reference points were linked; due to the evolutionary nature of this practice based research project, the contextual review has been an ongoing process. The review has involved constantly keeping up to date with new developments within the sector as well as dealing with the breadth and depth of the subject matter consulted. The results of the contextual review were then used to inform the case studies that were carried out in Chapter 5; which looked closely at a range of artists that work in both glass and ceramics. This in depth study enabled the research to be compared and contrasted with the work of other contemporary glass and ceramic practitioners in the field; which in turn helped to articulate the significance of the research.

6.3.2 Importance of mapping the links between glass and ceramics

The mapping that was undertaken as part of the contextual review (see section 2.3) was crucial to understanding the position of this research project; within the field of studio glass and ceramics. Several versions of the map of the field of contemporary practitioners were created throughout the research, which enabled the researcher to observe the field and work out where the gaps in practice were. It also aided the understanding of the problems that other practitioners face when combining glass and ceramics in their artworks; which identified a need for the research. Interaction with some of these artists through the case studies allowed for further discussions to take place. Knowledge transfer and advice were also encouraged and it became apparent in several cases that future collaborations will be possible to extend the practice of others as well as my own. The collaborative studies that were carried out with Professor Steve Dixon and Criss Chaney are a good example of this and were important to the positioning of the research as a viable model for others.

6.4 Conclusions relating to my artistic practice

In addition to the aims and objectives set out in this research project, there have been supplementary outcomes that have helped to develop my approach and practice much further then had been first expected. The production techniques and methods that have been developed; such as the techniques of kiln casting and hot casting glass with ceramic aggregates within large scale sculptural artworks will definitely be developed further in my future work. The creative potential that the research has generated will continue to have a huge impact on my future artistic practice. The process routes have the potential to be expanded and developed further to create new bodies of work that will significantly advance this research project and broaden its appeal to wider audiences. Future exhibitions of the artworks, the presentation of this project at relevant conferences and the publishing of aspects of this project in related journals will be the chosen means of dissemination.

The development of large scale sculptural forms (as previously discussed in Chapter 4), are new directions for my practice that will go on to be further developed in my future artistic practice. In looking at other artists within this chapter, it was possible to locate my practice alongside those that work in a similar way (see section 4.2). The research has substantially improved and developed my own art practice and will continue to have a major impact upon my work and how it is received in the wider context of studio glass and ceramics.

6.5 The Diversity of combining glass and ceramics in a hot state

Although other forms of combining glass and ceramics in both a hot and cold state are known and show a high level of technical expertise and artistic vision; the wide range of tests and distinctive artworks that have been developed as part of this research project offers a new diversity when working with both materials in a hot state. Having carefully reviewed the contemporary field, it can be claimed that new insights have emerged that challenge and extend existing visual qualities and technical knowledge. This has provided a practical model, directed at glass and ceramic practitioners in the field.

6.6 Original contribution to knowledge

The original contribution to knowledge that this research project offers comprises of:

1. The development of a range of potential process routes for a combined hot state system of glass and ceramics.
2. The development of an existing clay body which has been altered to create a compatible system (see section 3.5).
3. A series of potential process routes that offer a wide range of visual qualities and practical attributes (see section 3.9).
4. An evaluation of new production methods, in relation to the potential process routes (see section 3.4).
5. The development of potential process routes that are relevant to a range of artistic approaches, as exemplified in the work produced in the collaborative studies (see section 5.6).
6. The development and exhibition of a body of artworks that demonstrate the creative potential of the potential process routes (see Chapter 4).
7. A practical model of study compromising of tested process routes and artworks for other glass and ceramic practitioners interested in this subject to follow, in order to develop their own artworks that combine glass and ceramics (see section 6.2).
8. An artistic approach that realises the crossovers that exist between glass and ceramic production methods (see Chapter 4).
9. A study that draws together disparate information about the field which can be used as a resource for others working in the field (see Chapter 2).

6.7 Areas for further research and recommendations

During the research it became apparent that there were several areas for further research that had emerged. The application of the research and the implementation of these further areas could go on to improve and extend the combination of glass and ceramics, within the field of Art and Design. The research will also be of benefit to wider audiences, such as designers and architects who may be interested in a new material that combines both glass and ceramics and offers unique practical and visual attributes.

6.7.1 Further development of artworks

The artworks created in this research and discussed in Chapter 4 indicate potential creative possibilities and opportunities that could be further developed and expanded upon. The creation of large scale sculptural forms will merit further study, linked to the further study of paper clay to strengthen the ceramic when combined with glass. The potential process routes yet to be realised as artworks could also be further developed, in particular the application of Route 4: The combination of (a high fired) ceramic with hot glass.[94]

6.7.2 Further testing of clay bodies and glasses

Further tests will be carried out on other glass materials, for this study it was decided to concentrate solely on *Gaffer* casting and blowing glass a constant for the research, only the clay body was varied. Other glasses with a low co-efficient of expansion such as borosilicate glass (commonly used in lampworking) could be tested with different clay bodies. A series of tests with *Bullseye Glass* could also be carried out to see if the improved bone china body is compatible with this glass; this would extend the appeal of this research project to wider audiences as like *Gaffer Glass*, *Bullseye Glass* is widely used by many artists. Further tests with paper clay could also be carried out to improve the structure of the ceramic bodies when high quantities of quartz are present, so that more complex sculptural, larger scale forms could be created.

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[94] It was not possible to realise all of the tests as final artworks within the research time frame.

6.7.3 Further collaborative projects

It will also be of interest to work with some of the case study participants (see section 5.3) working with their materials to see how they can improve the hot state fit between their glass and ceramics. Particularly those that currently work with a *crackle* effect whom may want to try a balanced combined system; or those who have only worked with glass and ceramics in a cold state. The observed results of the collaborative projects have suggested further avenues of investigation. In particular the possibility of working with other clay bodies used in factories and a potential industrial application as seen in the Steve Dixon study. Additionally, glass companies such as *Gaffer Glass* and *Bullseye Glass* could be approached to run workshops with the new process routes or they may be interested in licensing the material that has been developed. Designers and architects could also be approached, to see if they would be interested in using the material in their work for industrial or architectural applications.

6.8 Final Remarks

The aims and objectives that were proposed at the onset of this research have been achieved and in some ways have surpassed my personal expectations. The contribution to knowledge includes a wide reaching range of benefits that others in the field may find interesting and of benefit to their practice. This could also be extended to wider audiences such as architects, designers and suppliers. As the research has evolved, further areas for research have been identified which suggests that this is an active subject of interest within the field of studio glass and ceramics; that still has research possibilities to be studied. In this further research, the future of combining glass and ceramics in studio practice can continue to be advanced and made accessible to wider audiences; improving creativity and promoting knowledge transfer within and beyond the field.

Appendix 1: List of HE institutions that teach glass & ceramics

1.1 Combined Glass & Ceramic departments within UK educational institutions

Educational institution (Chronologically by Location)	Qualifications offered	Current Head of Department
Buckinghamshire Chilterns University www.bcuc.ac.uk	Ceramics with glass BA (hons) & MA	Sue Bell sbell01@bc.uc.ac.uk
`	BA (Hons) Glass, Architectural Glass & Ceramics PhD	Peter Davies peter.davies@sunderland.ac.uk Colin Rennie colin.rennie@sunderland.ac.uk
Royal College of Art London www.rca.ac.uk	MA Ceramics & Glass MPhil PhD	Martin Smith martin.smith@rca.ac.uk

1.2 Separate Glass & Ceramic departments within UK educational institutions: Glass Departments

Educational institution (Chronologically by Location)	Qualification Offered	Current Head of Department
Dudley College of Technology, International Glass Centre www.dudleycol.ac.uk	HND 3-D Design Crafts (Glass)	
Edinburgh College of Art www.eca.ac.uk	BA (hons) Design & Applied Arts: Glass M.Des Glass PhD	Alison McConachie a.mcconachie@eca.ac.uk
University of Wolverhampton www.wlv.ac.uk	BA (Hons) Contemporary Applied Arts (Glass) MA Glass PhD	Stuart Garfoot s.garfoot@wlv.ac.uk
Central St Martin's London www.csm.arts.ac.uk	Post. Graduate certificate in Glass MA	Andrew Watson a.watson@csm.ac.uk Caroline Swash c.swash@csm.ac.uk
University of Sunderland www.sunderland.ac.uk	MA Glass	Kevin Petrie kevin.petrie@sunderland.ac.uk
Swansea Metropolitan University www.sihe.ac.uk	BA (hons) Architectural Glass MA Glass PhD	Vanessa Cutler

1.3 Separate Glass & Ceramic departments within UK educational institutions: Ceramic Departments

Educational institution (Chronologically by Location)	Qualification offered	Current Head of Department
UWIC, Cardiff Www.uwic.ac.uk	BA (hons) Ceramics MA Ceramics PhD	Delyth Done ddone@uwic.ac.uk Peter Castle pcastle@uwic.ac.uk
University of The Arts London, Camberwell College Www.camberwell.arts.ac.uk/	BA (hons) Ceramics	John Forde j.forde@camberwell.arts.ac.uk
Central St Martin's London Www.csm.arts.ac.uk	BA (hons) Ceramic Design MA Design: Ceramic, furniture or jewellery	Kathyrn Hearn k.hearn@csmart.ac.uk Simon Fraser s.fraser@csm.ac.uk
University of Sunderland Www.sunderland.ac.uk	MA Ceramics	Peter Davies peter.davies@sunderland.ac.uk Andrew Livingstone
University of Staffordshire Www.staffs.ac.uk	BA (hons) Ceramic Design BA (Hons) Surface Design for Ceramics MA Ceramic Design	John Webber j.a.webber@staffs.ac.uk David Sanderson d.sanderson@staffs.ac.uk
University of Wolverhampton Www.wlv.ac.uk	BA (Hons) Contemporary Applied Arts (Ceramics) MA PhD	Vicky Shaw v.shaw@wlv.ac.uk
Swansea Institute of Higher Education Www.sihe.ac.uk	BA (hons) Fine Art – Ceramics MA PhD	Harold Hope harold.hope@sihe.ac.uk
University of Central Lancashire Www.uclan.ac.uk	BA (hons) Ceramics MA Ceramics PhD	Dave Harper dpharper@uclan.ac.uk David Binns dsbinns@uclan.ac.uk
University of Westminster, Harrow	BA (hons) Ceramics	Kyra Kane

1.4 BA in 3-D Design or Applied Arts or Design Crafts: (with Glass &/or Ceramics)

Educational institution (Chronologically by Location)	Qualification offered	Current Head of Department
Gray's School of Art, Robert Gordon University http://www.graysartschool.co.uk/	BA Design & Craft MA (3-D Design leader) PhD	Libby Curtis Programme Director l.curtis@rgu.ac.uk Brian Glassar b.glassar@rgu.ac.uk
University of Creative Arts, Rochester College (Previously Surrey Institute) www.ucreative.ac.uk	BA (hons) 3-D Design BA 3-D Design (Ceramics, Glass, Metal or Jewellery) BA (Hons) Applied Arts MA Contemporary Crafts	Andrew Jackson Ajackson@ucreative.ac.uk
Manchester Metropolitan University, Faculty of Asrt & Design www.miriad.mmu.ac.uk www.mmu.ac.uk	MA & BA (hons) 3-D Design PhD	Ian Roberts i.d.roberts@mmu.ac.uk Alex McErlain a.mcerlain@mmu.ac.uk Fred McVittie f.mcvittie@mmu.ac.uk Anna Fenemore a.fenemore@mmu.ac.uk
North East Wales Institute www.newi.ac.uk	BA (Hons) Applied Arts MA Applied Arts PhD	Steven Keegan s.keegan@newi.ac.uk
Falmouth College of Art http://www.falmouth.ac.uk	BA (Hons) 3D Design MA Contemporary Crafts	Katie Bunnell katie@falmouth.ac.uk Justin Marshall justin.marshall@falmouth.ac.uk
University of Plymouth http://www.3ddesign.org.uk	BA (Hons) 3-D Design	Brian Adams B.Adams@plymouth.ac.uk
University of Wolverhampton www.wlv.ac.uk	BA (Hons) Contemporary Applied Arts	Sharon Watts s.watts@wlv.ac.uk
University of Staffordshire www.staffs.ac.uk	BA (Hons) Design Crafts	John Grayson j.e.grayson@staffs.ac.uk
De Montfort University, Faculty of Art & Design http://www.dmu.ac.uk	BA (Hons) Design Crafts	Jacky Oliver joliver@dmu.ac.uk
Plymouth College of Art	BA Applied Arts Ceramics Glass and Metals	Sue McGillverary

1.5 Glass & Ceramic Applied Arts Courses that are no longer running in the UK

Educational institution (Chronologically by Location)	Qualification offered	Date Closed
University of Central England, Birmingham Institute of Art & Design	Three Dimensional Design Ceramics with Glass	2006
Goldsmiths	Ceramics MA	1993
City Lit	Higher Ed Stained Glass Course	2005
Staffordshire University	Glass	2005
Manchester Metropolitan University	Contemporary Applied arts BA	2007
Glasgow School of Art ceramics	Ceramics	2008
Duncan of Jordanstone College of Art	Ceramics	2008
Kent Institute of Art and Design	Crafts	2008
University of Westminster, Harrow	BA (hons) Ceramics	2009
Edinburgh College of Art	BA (hons) Ceramics	2005

Appendix 2: Museums that show glass and ceramics

Appendix 2.1 Joint Museums dedicated to glass & ceramics

- Canadian Clay and Glass Gallery, Can www.canadianclayandglass.ca
- Jones Museum of Glass & Ceramics, Maine, USA
- Tehran Museum of Glass and Ceramics, Iran http://www.nationalmuseumofiran.com

Appendix 2.2 Museums dedicated to glass

- Anchor Hocking Glass Museum, Texas www.anchorhockingmuseum.com
- Barovier & Toso, Murano, Italy www.baroviertoso.it
- Bergstrom – Mahler Glass Museum, Wisconsin www.paperweightmuseum.com
- Blenko Museum, USA http://www.blenkomuseum.org/
- Blask Nada Gallery, Sweden http://www.blasknada.com
- Braggiotti Gallery, Amsterdam www.braggiotti.com
- Broadfield House Glass Museum, UK www.glassmuseum.org.uk
- Cambridge Glass Museum, Ohio http://www.cambridgeglass.org/
- Charleroi Glass museum www.charleroi-museum.org
- Cisternerne Museum of Modern Glass Art, Frederiksberg, Denmark http://www.cisternerne.dk/
- Corning Museum of Glass, USA http://www.cmog.org/
- Craigdarroch Glass Museum, Canada http://www.craigdarrochcastle.com
- Contemporary American and European Glass Museum, California http://glassmuseums.com/
- Danish Glass Museum, Glasmuseet Ebeltoft Denmark http://www.glass.dk
- Dorflinger Glass Museum, Pennsylvania USA http://www.dorflinger.org
- Dunkirk Glass Museum, Indiana, http://www.dunkirkpubliclibrary.com
- East Bohemian Museum, Pardabuice, CZ http://www.vcm.cz/
- Eda Glass Museum, Charlottenberg, Sweden http://www.edaglas.com/
- Ernsting-Stiftung Alter Herding Glass Museum, Coesfeld, Germany www.ernsting-stiftung.de/content/glasmuseum
- Ferrum College Museum, Cut Glass Collection Virginia http://www.ferrum.edu/
- Fenton Glass Museum, West Virginia http://www.fentonartglass.com/
- Fostoria Glass Museum, West Virginia http://www.fostoriaglass.org/
- Finnish Glass Museum, Riihimaki, FI http://www.riihimaki.fi
- Glass Art Museum Arad, Israel www.wamglassil.com
- Glass Art Museum, Cairo, Egypt, http://www.studioglasmuseum.net/
- Glass Museum Online, NZ http://www.glass.co.nz
- Glas Museum Alter Haf Herding, DE www.ernsting-stiftung.de
- Glas Museum Frauenau, DE www.glasmuseum-frauenau.deH
- Glass Museum - Hentrich, Dusseldorf, DE http://www.museum-kunst-palast.de

- Glas Galerie Hermann, DE www.glasgalerie-herrmann.de
- Glas Museum Hoogeveen, NL www.glasmuseum.nl
- Glas Museum Immenhausen, DE http://immenhausen.de/pages/museen.htm
- Glas Museum Rheinbach, DE http://www.glasmuseum-rheinbach.de/
- Glass Museum Schiedam, The Netherlands http://www.glasmuseum.nl/
- Glasturn Gmbh Petershagen, DE http://www.glas.turm.de/
- Historical Glass Museum, California http://www.rth.org http://glassmuseums.com/
- Iittala Glass Museum, Iittala, Finland http://www.iittala.com
- Johansfors-Glasbruk Museum, Stockholm http://www.johansfors-glasbruk.se/
- Koganezaki Crystal Park, Kamo-gun, Skizvoka-ken, Japan www.kuripa.co.jp
- Kosta Boda Glass Museum, Kosta, Sweden http://www.kostaboda.se/
- Lalique Museum, Hakone, Japan, http://www.lalique-museum.com
- Lindshammar Glasbruk Museum, Sweden http://www.lindshammarglasbruk.se/
- Liuli China Museum, Shanghai, China http://www.liulichinamuseum.com/
- Museum of Modern Glass, Kunst Sammlungen der Veste Coburg, Coburg, DE http://www.kunstsammlungen-coburg.de/
- Museum Vida Konsthall, Borgholm Sweden http://www.vdiamuseum.com
- Museum for Modernes Glas, Rodental bei Coburg, DE www.kunstsammlungen-coburg.de
- Museo de Vetro Di Altare, Italy www.isav.it
- Musee de Baccarat, Paris http://www.baccarat.com/intro.htm
- Museum of American Glass, Millville, USA http://www.wheatonvillage.org/museumamericanglass
- Museum of Glass, Carmaux, Ranska, France http://www.museeverre-tarn.com/
- Museum of Glass, Tacoma, USA http://www.museumofglass.org
- Museum of Glass, Riihimäki, Suomen, Finland http://www.suomenlasimuseo.fi/
- Sandwich Glass Museum, USA http://www.sandwichglassmuseum.org/
- Smalands Swedish Glass Museum, Vaxjo, Sweden http://www.smalandsmuseum.se/
- Stained Glass Museum, Ely, UK www.stainedglassmuseum.com/
- St Helens World Of Glass, St Helens UK http://www.worldofglass.com/
- Studio Glass Museum, (online only) Sweden http://www.studioglasmuseum.net/
- Turner Museum of Glass, Sheffield, UK http://www.shef.ac.uk/turnermuseum/collection
- National Glass Centre, Sunderland
- St Helen’s World of Glass

Appendix 2.3 Museums dedicated to Ceramics

- Ceramic Museum, Westerwald, DE www.keramikmuseum.de
- International Museum of Ceramics, Faenza, I http://www.racine.ra.it/micfaenza
- Museums of the Potteries, Staffordshire, UK http://www.stoke.gov.uk/museums/
- Museum of Oriental Ceramics, Osaka, JP http://www.moco.or.jp/en
- Schein-Joseph Museum of Ceramic Art, US http://www.ceramicsmuseum.alfred.edu

Appendix 2.4 Decorative, Applied Arts & Art Museum with Collections of Ceramics & Glass

- All-Russian Decorative-Applied and Folk Arts Museum, Moscow www.russianmuseums.info
- American Swedish Institute, Minnesota http://www.americanswedishinst.org/
- Arkansas Arts Center, Arkansas http://www.arkarts.com/
- Art Institute of Chicago, Chicago http://www.artic.edu/
- Art Nouveau & Art Deco Museum, Salamanca, Spain www.museocasalis.org
- Asheville Art Museum, North Carolina www.ashevilleart.org
- Baltimore Museum of Art, Baltimore http://www.artbma.org/
- Bellevue Arts Museums, Washington www.bellevueart.org
- Bennington Museum, Vermont www.benningtonmuseum.com
- Birmingham Museum of Art, Alabama, www.artsbma.org
- Bowes Museum, Barnard Castle, http://www.thebowesmuseum.org.uk/
- Bowers Museum of Cultural Art, California www.bowers.org
- Brooklyn Museum, New York http://www.brooklynmuseum.org/
- Brunnier Museum, Iowa www.museums.iastate.edu
- Broehan Museum, Berlin http://www.broehan-museum.de/
- Canterbury Museum, New Zealand http://www.canterburymuseum.com/
- Carnegie Museum of Art, Pennsylvania www.cmoa.org
- Centre Culturel de Recontre Abbage de Neumusnter, Luxembourg www.ccm.lu
- Chicago Historical Society, Chicago http://www.chicagohistory.org/
- Christopher Columbus Museum, Wisconsin http://www.columbusantiquemall.com/
- Chrysler Museum of Art, Virgina http://www.chrysler.org/
- City Museum, Missouri www.citymuseum.org
- Colorado Springs Fine Arts Center, Colorado csfineartscenter.org
- Colombia Museum of Art, Columbia http://www.columbiamuseum.org/
- Cooper Hewitt National Design Museum, New York www.cooperhewitt.org
- Contemporary Museum of Honolulu, Hawaii http://www.tcmhi.org/
- Currier Museum, New Hampshire http://www.currier.org/

- Danish Museum of Art & Design, Copenhagen, DK http://www.kunstindustrimuseet.dk/
- DAR Museum, Washington www.dar.org/museum
- De Young, California www.famsf.org/deyoung/
- Design Museum Helsinki, Finland http://www.designmuseum.fi/
- Design Museum, London http://www.designmuseum.org/
- Design Museum, Gent, London http://design.museum.gent.be/
- DeWitt Wallace Decorative Arts Museum, Colonial Williamsburg Foundation, Virginia www.history.org
- Doiron Gallery, California, http://www.doirongallery.com/
- Eretz Isreal Museum, Tel Aviv http://www.eimuseum.co.il
- Estonian Museum of Applied Art & Design, Tallinn Estonia www.trtr.ee
- Everhart Museum, Pennsylvania www.everhart-museum.org
- Fuller Craft Museum, Massachusetts http://www.fullercraft.org/
- Fundacion Centro Nacional del Vidrio, Segoria, Spain http://www.fcnv.es
- Gemeentemuseum, The Hague, NL www.gemeentemuseum.nl
- Getty Museum, California http://www.getty.edu/
- Greenboro Historical Museum, North Carolina http://www.greensborohistory.org/
- Hamilton Art Gallery, Victoria, Australia, http://www.hamiltongallery.org/
- Hancock Historical Museum, Ohio http://www.hancockhistoricalmuseum.org/
- Henry Ford Museum, Michigan http://www.thehenryford.org/
- Hickory Museum of Art, North Carolina, http://www.hickorymuseumofart.org/home.php
- High Museum of Art, Georgia, http://www.high.org/
- Hillwood Museum, Washington http://trio.hillwoodmuseum.org/art.php
- Hokkaido Museum of Modern Art, Japan www.aurora-net.or.jp
- Horation Colony Museum, New Hampshire http://www.horatiocolonymuseum.org/
- Houston Center for Contemporary Craft, Texas http://www.crafthouston.org/
- Houston Museum of Decorative Arts, Tennessee http://www.thehoustonmuseum.com/
- Huntington Museum of Art, West Virginia, http://www.hmoa.org/
- Illinois State Museum, Illinois http://www.museum.state.il.us/
- Kemper Museum for Contemporary Art & Design, USA http://www.kemperart.org
- Kentuck Museum, Alabama, http://www.kentuck.org/
- Kopavogar Art Museum, Gerdarsafn, Iceland www.gerdarsan.is
- Kunstsmuseum Dusseldorf, DE www.kunstmuseum-dusseldorf.com
- Lambton Heritage Museum, Ontario, Canada http://www.lambtononline.ca
- Leigh Yawkey Woodson Art Museum, Wisconsin http://www.lywam.org/
- Les Arts Decoratifs, Paris http://www.lesartsdecoratifs.fr/
- Lightner Museum Florida, http://www.lightnermuseum.org/

- Liuligongfang Museum, Shanghai, China www.liuli.com/museum
- Los Angeles County Museum of Art, California http://www.lacma.org/
- Lux Center for the Arts, Nebraska http://www.luxcenter.org/
- Municipio de Marinha Grande, Portugal http://www.mmgrande.pt
- Moritex Corporation, Tokyo, Japan www.moritex.com
- Museum Bellerive, Zurich, Switzerland http://www.museum-bellerive.ch/
- Museum de Design et d'arts Contemporains, Lausanne, Switzerland www.lausanne.ch
- Museum Jan Van der Togt, NL www.jvdtogt.com
- Museum Kunst Palast, Deusseldorf, DE www.museum-kunstpalast.de
- Museum of London http://www.museumoflondon.org.uk
- Museo Revoltella, Trieste, Italy www.museorevotella.it
- National Museums Liverpool http://www.liverpoolmuseums.org.uk
- Portland Museum of Art, USA http://www.portlandmuseum.org
- Prague Museum of Decorative Arts, CZ http://www.upm.cz
- Rijksmuseum, Amsterdam, NL www.rijksmuseum.nl
- Shipley Art Gallery, Gateshead, UK. http://www.twmuseums.org.uk/shipley
- Suntory Museum of Art, Tokyo, Japan www.suntory.co.jp
- Tullie House Museum, Carlisle, UK http://www.tulliehouse.co.uk
- Toledo Museum of Art, US http://www.toledomuseum.org
- Ulster Museum, Belfast, Ireland http://www.ulstermuseum.org.uk
- Victoria & Albert Museum http://www.vam.ac.uk
- Westfalisches Industriemuseum, Petershagen, DE http://www.petershagen.de/
- WWW virtual library museum http://icom.museum/vlmp/

Appendix 3: A list of completed and ongoing PhD research degrees in the field

Researcher, Institution/date Completed	Subject area	Research Proposition	Methods used	Format of Thesis
Julian Malins (1993) RGU	1 Ceramics	Ceramics/ environmentally safe firing systems	• Experimental kiln design • Glaze tests • Laboratory methods • Visual evaluation using semantic differential methods	Illustrated written text Video of firing processes & capture of reflective glaze surfaces Presentation of fired ceramics
Eleanor Wheeler (1996) Northumbria	2 Ceramics	Architectural ceramics/ use of glazed brick/tiles as features integral to buildings	• Four commissioned site-specific as case studies • Interviews with residents, architects, clients • Clay & glaze experiments	Site specific architectural ceramics Illustrated written text Exhibition – documentation of sites & related work
Laura Johnston (1997) Sunderland	1 Glass	Architectural glass/ use of coated glass surface in architecture	• Commissioned site-specific as case studies • Glass experiments	Illustrated written text Presentation of coated glass Exhibition – documentation of sites & related work
Katie Bunnell (1998) RGU	3 Ceramics	Ceramic designer maker practice/integration of new technology	• CAD/CAM, 2D/3D modelling techniques to develop an experimental range of objects • Databases for storage & management of multimedia data • Peer review through invited national/international exhibitions	Thesis in digital format (on CD-Ron with a series of linked databases)
Justin Marshall (1999) UWIC	4 Ceramics	Designer maker practice/integration CAD/CAM	• CAD/CAM, 2D/3D modelling techniques to develop an experimental range of objects	Thesis in digital format
Richard Slade (1999) RCA	5 Ceramics	Ceramics/ Glaze technology	• Glaze tests	Illustrated written text Presentation of fired ceramics
Kevin Petrie (1999) UWEI	6 Ceramics	Printed ceramics/ transfer technology	• Printed tests • Laboratory methods	Illustrated written text Presentation of printed ceramics Exhibition – related work
Aaron McCartney (2001) Central St Martins	2 Glass	Glass casting/ mould technology	• Industrial mould production	Illustrated written text Presentation of cast glass Exhibition – related work
Ray Flavell (2001) ECA	3 Glass	Applied art/glass as a means of drawing & expression	• 'reflective risk methodology • material experimentation • visual documentation of making processes (including video clips)	Thesis as an acrobat document on DVD which includes video clips

(List continued)

Researcher, Institution/date completed	Subject area	Research Proposition	Methods used	Format of Thesis
Richard Slade (2002) RCA	7 Ceramics	Auto-reductive glazes	• Glaze tests • Laboratory methods	Illustrated written text Presentation of glaze test and glazed ceramic artworks
Natasha Mayo (2004) UWIC	8 Ceramics	Ceramics as a means of expressively rendering flesh	• Clay tests	Illustrated written text Presentation of artworks
Ross Head (2006) SIHE	4 Glass	CAD/CAM Digital Modelling of glass	• CAD/CAM, 2D/3D modelling techniques to dev. Range of models	Illustrated written text Presentation of designs
Vanessa Cutler (2006) Sunderland	5 Glass	Abrasive water jet technology for cutting glass	• CAD, 2D modelling techniques to dev. an experimental range of objects	Illustrated written text Presentation of tests and artworks
Babette Martini (2006) UWIC	9 Ceramics	Figurative Ceramics	• Clay tests	Illustrated written text Presentation of ceramic artworks
Andrew Livingstone (2006) Belfast	10 Ceramics	Authenticity in Ceramics	• Clay tests	Illustrated written text Presentation of ceramic artworks
Bonnie Kemske (2007) RCA	11 Ceramics	Ceramics as a means of expressing touch & tactility	• Clay tests	Illustrated written text Presentation of ceramic artworks
Carole Metcalfe (2007) Sunderland	12 Ceramics	New ash glazes from arable sources	• Glaze tests • Laboratory methods & analysis	Illustrated written text Presentation of ceramic glaze tests and glazed artworks
Neil Brownsword (2006) Bucks& Chilterns	13 Ceramics	The production history of the North Staffordshire Pottery Industry, linked to the loss of traditional craft skills involved in ceramic manufacture	• Clay tests • Combined historical and archaeological research on Staffordshire's ceramic production • Documentation of production at the potteries	Illustrated written text Presentation of ceramic artworks
Hayley Daniels (2007) UWIC	14 Ceramics	Figurative Ceramics	• Clay tests	Illustrated written text Presentation of ceramic artworks
Claudia Clare (2007) Westminster	15 Ceramics	'Shattered' Ceramic material as a metaphor for feminine stories.	• Clay tests	Illustrated written text Presentation of ceramic artworks
Alasdair Bremner (2009) UCLAN	16 Ceramics	Concrete Aggregates in ceramic practice	• Clay & aggregate tests	Illustrated written text Presentation of ceramic aggregate tests and artworks
Tyra Oseng (2009) Swansea	6 Glass	Recycled glass bottles	• Compatibility tests • Laboratory methods	Illustrated written text Presentation of recycled glass tests and artworks
Wayne Strattman (2009) Sunderland	7 Glass	Neon techniques in glass making	• Glass tests	Illustrated written text & range of relating publications

Appendix 4: Compatibility Tests

Test 1 Bow test:

The rate of expansion is measured by preparing two thin plates of glass and ceramics in a 1:1 ratio, which are then fired together. Thermal contraction can then be calculated by measuring how much one layer has expanded more or less than the other.

Test 2 Strain energy test:

The rate of expansion is measured by varying the amount of glass set into a ceramic inlay. The thermal expansion can then be determined by measuring the length of the crack within the ceramic inlay.

Test 3 Freezer test:

After fusing the test is put in the freezer for around a day, removed it and allowed to return to room temperature. If it has not cracked, it is assumed stress-free enough to use. [95]

Test 4 Polarized lens test:

This test is commonly used to measure the compatibility of two glasses. This test requires that you have two polarized lenses or a *polariscope* or *polarimeter*[96]; a specialist device made for this purpose. After fusing the test, place the two pieces of polarized film on either side of the test and hold it over a light source. Turn the lenses so that they are at right angles to each other checking the edges where the different glasses come together for a white glow. The brightness of this glow determines the severity of the stress and the degree of incompatibility. If there is no glow, or only a slight halo, then the glass can be assumed to be compatible. Greater amounts of incompatibility shown by more light may mean that the piece is useable, but that it is more likely to crack with use (Bray, 1995, p.188).

Test 5 Base glass test:

This test builds on the polarized lens test already described. A larger piece of clear 'base' glass is used as a control glass against which to test the fused glass. The test is fused flat to around 815°C and annealed. The fused test is viewed under a *polarimeter* as previously discussed. Also known as the Trident Seal test.

Test 6 Dilatometer test:

This test is commonly used to measure the thermal expansion of a ceramic body and glaze. The test piece is preheated to 900°C and set into the machine, interval temperature ranges are then taken every 5 minutes; the results are then analysed to measure the differing co-efficient of expansion (Ryan & Radford, 1987, pp.236-238).

[95] This is a general test for stress not a true compatibility test.

[96] A stress viewer.

Appendix 5: Materials Testing Phase 1

Materials Testing Phase 1
Route 1A

Title: The combination of slip cast ceramics with glass frit

Date: 08.03.05 Cast
10.03.05 Bisque Fired
12.03.05 High Fired

Description: Tiles & Boat shape & Triangle shape form

Number: 1Ai – 1Avi & 1Avii – 1Aviii

Size: 40mm x 40mm

Material: Standard Porcelain slip (Valentines)
Phillips studio glass, 500 mesh & 1000 mesh

100ml Slip +	20g 500 mesh frit	1A i
	15g 500 mesh frit	1A ii
	10g 500 mesh frit	1A iii
100ml Slip +	20g 1000 mesh frit	1A iiii
	15g 1000 mesh frit	1A v
	10g 1000 mesh frit	1A vi
400ml Slip +	100g 1000 mesh frit	1A vii
200ml Slip +	50g 1000 mesh frit	1A viii

Firing range: 1000°C bisque
1280 fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Observations: Test tile didn't crack when bisque fired; very small particles of glass came out at sides, necessary to cut tiles to reveal glass inside.
In the high fired test the glass melted embodying the ceramic. Forming an interface layer as well as melting through the porcelain.
Varying degrees of glass frit in Standard Slip Body.

Suggestions:

Image:


Test 1Ai


Test 1Aii


Test 1Aiii


Test 1Aiv


Test 1Av


Test 1Avi


Test 1Avii


Test 1Aviii

Materials Testing Phase 1
Route 2A

Title: The combination of a biscuit/fully fired ceramic setter with glass frit

Date: 13.03.05 Cast
15.03.05 Bisque Fired
17.03.05 High Fired

Number: 2Ai - 2Aiv

Description:

Size: 100mm x 100mm Tiles

Material: Standard Porcelain slip (Valentines)
Phillips studio glass

High fired setter
Diamond cut at bisque to create hollows for frit

100ml Slip + 20g 500 mesh frit layered onto High fired porcelain	2Ai
100ml Slip + 20g 500 mesh frit layered onto High fired porcelain	2Aii
100ml Slip + 20g 500 mesh frit layered onto High fired porcelain	2Aiii
100ml Slip + 20g 500 mesh frit layered onto High fired porcelain	2Aiv

Firing range: 1000°C bisque
1280°C fully fired

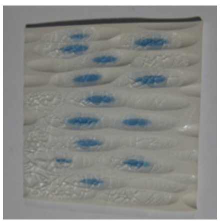
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Observations: Test tile didn't crack when high fired, Surface cracking is occurring in the glassy surface. The ceramic needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant whereas the ceramic will be the variable.

Suggestions: Try annealing glass at 520°C and soak for 30 minutes
High fire porcelain then refine at lower glaze temperature
Use ceramic body with lower COE and glass with lower COE

Image:


Test 2Ai


Test 2Aii


Test 2Aiii


Test 2Aiiii

Materials Testing Phase 1
Route 2B

Title: The combination of a (high fired) ceramic setter with glass

Date: 30.03.05

Description: Stalactite form

Number: 2Bi - 2Bvi

Size: 100mm x 120mm Tiles

Material: Standard Porcelain slip (Valentines)
Phillips studio glass 500 mesh

100ml Slip +	30g 1000 mesh frit layered onto bisque fired porcelain	2Bi
100ml Slip +	40g 1000 mesh frit layered onto bisque fired porcelain	2Bii
100ml Slip +	30g 1000 mesh frit layered onto high fired porcelain	2Biii
100ml Slip +	40g 1000 mesh frit layered onto high fired porcelain	2Bvi

Firing range: 1000°C Biscuit fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1000°C
0.15 min soak
Skip 20°C end

Firing range: 1280°C High fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Observations:

Form didn't crack when high fired, Surface cracking is occurring in the glassy surface. The ceramic needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant whereas the ceramic will be the variable.

Suggestions:

Try annealing glass at 705°C & 800°C High fire porcelain then refine at lower glaze Temperature Use ceramic body with lower COE and glass with lower COE
Try High fired Body

Image:


Test 2Bi


Test 2Bii


Test 2Biii


Test 2Bvi

Materials Testing Phase 1
Route 2C

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 27.5.8

Description: Round tile

Number: 2Ci - 2Cxiii

Size: 80mm x 80mm

Material: Various slips Valentines, Scarva & Potclays
Phillips studio glass 500 mesh

100ml Slip White stoneware + 20g 500 mesh frit	2Ci
100ml Slip Premium Craft Crank + 20g 500 mesh frit	2Cii
100ml Slip Earthenstone + 20g 500 mesh frit	2Ciii
100ml Slip SP Porcelain + 20g 500 mesh frit	2Civ
100ml Slip White stoneware crank + 20g 500 mesh frit	2Cv
100ml Slip Fine Bone China + 20g 500 mesh frit	2Cvii
100ml Slip HF Porcelain + 20g 500 mesh frit	2Cviii
100ml Slip Porcelain + 20g 500 mesh frit	2Cviiii
100ml Slip Porcelain Southern Ice + 20g 500 mesh frit	2Cx
100ml Slip Porcelain Cast Body slip + 20g 500 mesh frit	2Cxi
100ml Slip DL Porcelain + 20g 500 mesh frit	2Cxii
100ml Slip White slip + 20g 500 mesh frit	2Cxiii

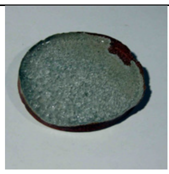
Firing range: 1280/1260°C fully fired
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280 or 1260°C
0.15 min soak
Skip 20°C end

Observations: Glass cracked on all - not compatible

Suggestions: Try firing glass at 700°C and annealing schedule

Image:


Test 2Ci


Test 2C


Test 2C


Test 2C


Test 2C


Test 2C


Test 2C

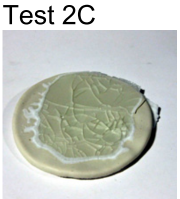

Test 2C


Test 2C


Test 2C


Test 2C


Test 2C


Test 2C

Materials Testing Phase 1
Route 2D

Title:	The combination of a (high fired) ceramic setter with glass frit

Date: 01.05.05

Description: Slice form – test artwork

Number: 2Di & 2Dii

Size: 120mm x 40mm

Material: Standard Porcelain Slip (Valentines)
Phillips studio glass 1000 mesh

80ml Slip +	5g 500 mesh frit	2Di
80ml Slip +	10g 500 mesh frit	2Dii

Firing range: 1280°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Observations:

Form didn't crack when high fired, some Surface cracking is occurring in the glassy surface. The ceramic needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant whereas the ceramic will be the variable.

Suggestions:

Try firing glass at 750°C and annealing at 520°C High fire porcelain then refine at lower glaze temperature. Use ceramic body with lower COE and glass with lower COE

Image:


Test 2Di


Test 2Dii

Materials Testing Phase 1
Route 2E

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 01.05.05

Description:

Number: 2Ei & 2Eii

Size: 120mm x 8mm

Material: Standard Porcelain slip (Valentines)
Phillips studio glass 1000 mesh

80ml Slip +	5g 500 mesh frit	2Ei
80ml Slip +	10g 500 mesh frit	2Eii

Firing range: 1280°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Firing Range: 650°C fuse

Glass Prog:

75°C /hr to 510°C	
200°C /hr - 650°C	15min soak
250°C /hr to 510°C	3hr soak
8°C /hr to 405°C	
16°C /hr to 250°C	Off

Observations:

Form didn't crack when high fired.

Suggestions:

Wall paper paste used to bind left an opaque finish use glass glue instead

Image:


Test 2E i


Test 2E ii

Materials Testing Phase 1
Route 3A

Title: The combination of kiln glass with ceramic frit

Date: 06.05.05 Cast

Number: 3Ai

Description:

Size: 80mm x 50mm Egg form

Material: Standard Porcelain Slip (Valentines) Bisque fired aggregate
Phillips studio glass

190g Glass frit 500+ mesh & 25g bisque fired ceramic aggregate 3Ai

Glass Prog: 650°C fuse (pâte de verre)

Firing cycle:

120°C /hr to 650°C	1hr soak
100°C /hr to 520°C	30min soak
5°C /hr to 510°C	2hr soak
30°C /hr to 300°C	Off

Observations: Test didn't fuse together, crumbling. Porcelain stopped glass from flowing. Under fired not gone high enough to melt the glass. A light fusing has occurred. Necessary to go to 750°C, to get a melted, interface that is bonded. Also important to use ingots of porcelain as it can dissolve in the glass if too fine.

Suggestions: Fuse glass at higher temperature 750°C, use high fired aggregate

Image:

Test 3Ai

Materials Testing Phase 1 **Route 3B**

Title: The combination of kiln glass with ceramic frit

Date: 06.05.05

Number: 3Bi – 3Bii

Description: Boat Form – test artwork

Size: 300mm x 150mm

Material: Standard Porcelain Slip (Valentines) Bisque & High fired aggregate
Phillips studio glass

550g Glass frit 1000+ mesh & 50g Bisque fired ceramic aggregate	3Bi
550g Glass frit 1000+ mesh & 50g High fired ceramic aggregate	3Bii

Glass Prog: 800°C cast

Firing cycle:

120°C /hr to 800°C	1hr soak
100°C /hr to 520°C	30min soak
5°C /hr to 510°C	2hr soak
30°C /hr to 300°C	Off

Observations: All didn't fuse together, porcelain stopped glass from flowing. Cracking occurred in high fired aggregate test 3Bii

Suggestions: Use less glass, or
Pre-glazed fully fired porcelain chips
Fuse glass higher temperature

Image:

Test 3Bi

Test 3Bii

Materials Testing Phase 1
Route 3C

Title: The combination of kiln glass with ceramic frit

Date: 06.05.05 Cast

Number: 3Ci

Description:

Size: 110mm x 110mm Disc

Material: Standard Porcelain Slip (Valentines) High fired aggregate
Phillips studio glass 1000+ mesh

3Ci 340g Glass frit & 80g High Fired ceramic aggregate

Glass Prog: 800°C cast

Firing cycle:

120°C /hr to 800°C	1hr soak
100°C /hr to 520°C	30min soak
5°C /hr to 510°C	2hr soak
30°C /hr to 300°C	Off

Observations: All didn’t fuse together, porcelain stopped glass from flowing

Suggestions: Use less glass, or
Pre-glazed fully fired porcelain chips
Fuse glass higher temperature

Image:


Test 3Ci


Test 3Ci Detail (Base)

Materials Testing Phase 1
Route 3D

Title: The combination of kiln glass with ceramic frit

Date: 19.05.05

Number: 3Di – 3Diii

Description:

Size: 60mm x 40mm & 80mm x 100mm & 120mm x 120mm Blown Hot Glass form

Material: Standard Porcelain Slip (Valentines) High fired aggregate
Phillips studio glass frit 500 + mesh
Philips studio glass

200g Blown glass + 10g Glass Frit & 10g ceramic aggregate	3Di
620g Blown glass + 15g Glass Frit & 15g ceramic aggregate	3Dii
750g Blown glass + 25g Glass Frit & 25g ceramic aggregate	3Diii

Glass Prog: 705°C Fuse

Firing cycle:

75°C /hr to 510°C	
200°C /hr - 705°C	15min soak
250°C /hr to 510°C	3hr soak
8°C /hr to 405°C	
16°C /hr to 250°C	Off

Observations:

Porcelain cracked glass when fused within glass. Light cracking occurred the ceramic body needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant.

Suggestions:

Balance COE – find different ceramic body, bone china?

Image:


Test 3Di


Test 3Dii


Test 3Diii

Materials Testing Phase 1
Route 3E

Title: The combination of kiln glass with ceramic frit

Date: 29.05.05

Number: 3Ei

Description: Blown glass 'Emergence' form with high fired aggregate – test artwork

Size: 100mm x 60mm

Material: Standard Porcelain Slip (Valentines) High fired aggregate
Phillips studio glass frit 500+ mesh
Phillips studio glass

40g Blown glass + 5g ceramic & glass frit 3Ei

Glass Prog: 705°C Fuse (Pâte de verre)

Firing cycle:

	75°C /hr to 510°C	
	200°C /hr - 705°C	15min soak
	250°C /hr to 510°C	3hr soak
	8°C /hr to 405°C	
	16°C /hr to 250°C	Off

Observations:

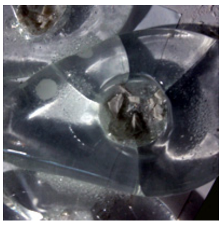
Porcelain cracked glass when fused within glass. Severe cracking occurred in the glass, the ceramic body needs to be altered to match the thermal expansion of the glass (see detail below). The glass will need to remain constant.

Suggestions:

Balance COE

Image:


Test 3Ei


Detail

Materials Testing Phase 1
Route 4A

Title: The combination of a ceramic core encapsulated with hot glass

Date: 09.05.05

Number: 4Ai – 4Aii

Description: Bisque Porcelain Egg & encapsulated in blown hot glass

Size: 80mm x 50mm Porcelain form encapsulated in hot glass

Material: Standard Porcelain Slip (Valentines) Bisque fired aggregate
Phillips studio glass

470g Blown glass + 20g Bisc/Fired ceramic	4Ai
440g Blown glass + 20g Bisc/Fired ceramic	4Aii

Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C

Annealing cycle:

Full to 520°C	30min soak
5°C hr to 510°C	2hr soak
30°C hr to 300°C	Off

Observations: Porcelain cracked glass when encapsulated with glass.
Porcelain stayed whole.
Severe cracking is occurring the ceramic body needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant.

Suggestions: Look at balancing COE
Use vitrified high fired porcelain

Image:


Test 4i


Test 4ii

Materials Testing Phase 1
Route 4B

Title: The combination of a ceramic core trailed with hot glass

Date: 09.05.05

Description: Bisque Porcelain Egg forms trailed with hot glass

Number: 4Bi

Size: 80mm x 50mm

Material: Standard Porcelain Slip (Valentines) Bisque fired aggregate
Phillips studio glass

5g Blown glass + 50g Bisc/Fired ceramic 4Bi

Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C

Annealing cycle:

Full to 520°C	30min soak
5°C /hr to 510°C	2hr soak
30°C /hr to 300°C	Off

Observations: Glass cracked porcelain when trailed with glass.
Looked as though the porcelain repelled the glass, as it didn't adhere to the surface.

Suggestions: Look at balancing COE
Use vitrified high fired porcelain

Image:

Test 4Bi

Materials Testing Phase 1
Route 4C

Title: The combination of ceramic elements encapsulated with hot glass

Date: 19.05.05

Description: Fully fired porcelain inclusions & encapsulated within hot glass

Number: 4Ci & 4Cii

Size: 50mm x 80mm glass form with porcelain inclusions (discs)

Material: Standard Porcelain Slip (Valentines) High fired inclusions
Phillips studio glass

4Ci 80g Blown glass + 20g High Fired porcelain
4Cii 80g Blown glass + 30g High Fired porcelain

Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C

Annealing cycle:		
	Full to 520°C	30min soak
	5°C /hr to 510°C	2hr soak
	30°C /hr to 300°C	Off

Observations: Porcelain cracked glass when encapsulated within glass.
Severe cracking is occurring the ceramic body needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant.

Suggestions: Look at balancing COE

Image:


Test 4Ci


Test 4Cii

Materials Testing Phase 1
Route 4D

Title: The combination of ceramic elements encapsulated with hot glass

Date: 19.05.05

Description: Fully fired porcelain inclusions cast within hot glass

Number: 4Di & 4Dii

Size: 100mm x 160mm cast glass

Material: Standard Porcelain Slip (Valentines) High fired inclusions
Phillips studio glass

900g Blown glass + 60g High Fired porcelain 4Di
700g Blown glass + 60g High Fired porcelain 4Dii

Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C

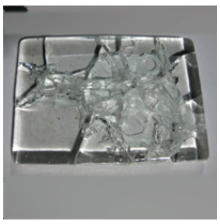
Annealing cycle:

	down to 520°C	30min soak
	5°C /hr to 510°C	2hr soak
	30°C /hr to 300°C	Off

Observations: Porcelain cracked glass when encapsulated within glass.
Severe cracking occurred; the ceramic body needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant.

Suggestions: Look at balancing COE

Image:


Test 4Di


Test 4Dii

Materials Testing Phase 1
Route 4E

Title: The combination of ceramic elements encapsulated with hot glass

Date: 19.05.05

Description: Cast glass 'Evolve' form with fused high fired ceramic – test artwork

Number: 4Ei

Size: 200mm x 260mm

Material: Standard Porcelain Slip (Valentines) High fired aggregate
Phillips studio glass

3000g Blown glass + 90g ceramic aggregate 4Ei

Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C

Annealing cycle:	Full to 520°C	30min soak
	5°C /hr to 510°C	2hr soak
	30°C /hr to 300°C	Off

Observations: Porcelain cracked glass when cast within glass.
Light cracking occurred the ceramic body needs to be altered to match the thermal expansion of the glass. The glass will need to remain constant.

Suggestions: Look at balancing COE

Image:


Test 4Ei

Materials Testing Phase 2

Materials Testing Phase 2: **Route 1B**

Title:	The combination of slip cast ceramics with glass frit
Date:	27.5.8
Description:	Quartz addition to Porcelain body
Number:	1Bi-1Biiii
Size:	80mm x 80mm Round Tiles, Diamond cut with olive cut
Material:	Standard Porcelain Slip (Valentines) Phillips studio glass Quartz Silica Sand

100ml Slip +	10g Quartz 500 mesh frit	1B i
	7.5g Quartz 500 mesh frit	1B ii
	5g Quartz 500 mesh frit	1B iii
	2.5g Quartz 500 mesh frit	1B iv

Firing range:	1280°C fully fired
Firing cycle:	100°C /hr to 400°C 150°C /hr to 1280°C 0.15 min soak Skip 20°C end

Observations:	Test tile didn't crack when high fired. In the high fired test the glass melted embodying the ceramic.
Suggestions:	Varying degrees of quartz, stress visible in tile, need to fire using glass schedule & annealing

Image:


Test 1Bi


Test 1Bii


Test 1Biii


Test 1Biv

Materials Testing Phase 2:
Route 1C

Title: The combination of slip cast ceramics with glass frit

Date: 2.6.8

Description:

Number: 1Ci -1Cvi

Size: 80mm x 80mm Round Tiles, Pottery Crafts clay bodies + Frit + 1 Valentines

Material: Pottery Crafts clay bodies
Phillips studio glass 500 + mesh frit

100ml Slip +	Bone China + 20g glass frit	1C i
100ml Slip +	DL Porcelain + 20g glass frit	1C ii
100ml Slip +	White earthenware throwing + 20g glass frit	1C iii
100ml Slip +	White earthenware + 20g glass frit	1C iv
100ml Slip +	Ivory earthenware + 20g glass frit	1C v
100ml Slip +	Porcelain (Valentines) + 20g glass frit	1C vi

Firing range: 1280°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C
0.15 min soak
Skip 20°C end

Observations: Cracked

Suggestions: Fire at glass schedule and anneal

Image:


Test 1Ci


Test 1Cii


Test 1Ciii


Test 1Civ


Test 1Ciiii


Test 1Ciiii

Materials Testing Phase 2: **Route 2F**

Title:	The combination of a (high fired) ceramic setter with glass frit
Date:	27.6.8
Description:	
Number:	2Fi -2iv
Size:	80mm x 80mm Round Tiles, Porcelain + Quartz (Diamond cut with olive cut)
Material:	Standard Porcelain Slip (Valentines) Phillips studio glass 500 mesh frit Quartz Silica Sand

100ml Slip +	100g Quartz +20g Glass frit	2F i
	75g Quartz +20g Glass frit	2F ii
	50g Quartz +20g Glass frit	2F iii
	25g Quartz +20g Glass frit	2F iv

Firing range:	1280°C fully fired	
Firing cycle:	100°C /hr to 400°C 150°C /hr to 1280°C 0.15 min soak Skip 20°C end	
Glass Prog:	750°C Fuse	
Firing cycle:	75°C /hr to 510°C	
	200°C /hr to 750°C	15min soak
	250°C /hr to 510°C	3hr soak
	8°C /hr to 405°C	
	16°C /hr to 250°C	Off

Observations:	Glass didn't fully melt
Suggestions:	Fire glass higher to 800°C to cast

Image:


Test 2Fi


Test 2Fii


Test 2Fiii


Test 2Fiv

Materials Testing Phase 2:
Route 2G

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 6.5.9

Description: Readymade Bone China Flowers + 3 different glass frits

Number: 2Gi -2Gvi

Size: Approx: 30 x 30mm

Material: High fired Bone China Flower
Phillips studio glass frit
Gaffer glass casting frit
PVS glass frit

2g Phillips	+5g BC Flower 2G i	fuse 750°C	2Gi
2g Phillips	+5g BC Flower 2G ii	fuse 725°C	2Gii
2g Gaffer	+5g BC Flower 2G iii	fuse 750°C	2Giii
2g Gaffer	+5g BC Flower 2G iv	fuse 725°C	2Giv
2g PVS	+5g BC Flower 2G v	fuse 750°C	2Gv
2g PVS	+5g BC Flower 2G vi	fuse 725°C	2Gvi

Glass Prog: 725°C / 750°C Fuse

Firing cycle:

150°C /hr to 725°C /750°C	30 mins soak
200°C /hr to 450°C	30 mins soak
10°C /hr to 440°C	1hr soak
20°C /hr to 250 °C	END

Observations: 725°C too low / 750°C is optimum with all frits, no cracking or visible surface tension

Suggestions:

Image:

Test 2Gi

Test 2Gii

Test 2Giii

Test 2Giv

Test 2Gv

Test 2Gvi

Materials Testing Phase 2:
Route 2H

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 14.7.9

Description: Egg cup paper forms

Number: 2Hi -2Hiii

Size: 40 x 40mm

Material: Bone China (Potterycrafts) BC + Quartz
Porcelain (Valentines) P + Quartz
Bone China (Spode) BCS + Quartz
Phillips studio glass frit
Quartz Silica Sand (Pre-mixed with 100ml wet slip – 100g quartz)
Paper pulp

5g BC	Slip + 5g Frit	2Hi
5g P	Slip + 5g Frit	2Hii
5g BCS	Slip + 5g Frit	2Hiii

Firing range: 1280°C/1260°C fully fired

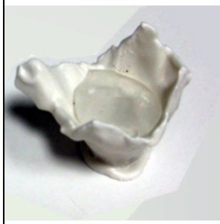
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 780°C

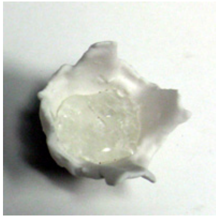
Firing cycle:		
	200°C /hr to 780°C	30 mins soak
	110°C /hr to 510°C	3hrs soak
	8°C /hr to 405°C	1hr soak
	16°C /hr to 250 °C	END

Observations: Porcelain cracked no issues with bone china bodies.

Suggestions: Porcelain not compatible


Test Hi


Test Hii

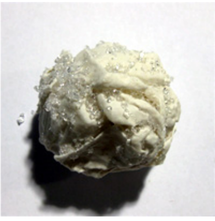

Test Hii

Materials Testing Phase 2:
Route 2I

Title:	The combination of a (high fired) ceramic setter with glass frit	
Date:	30.7.9	
Description:	Paper ball – test artwork	
Number:	2Ii -2Iii	
Size:	70 x 70mm	
Material:	Bone China (Potterycrafts) BC Paper pulp Quartz Silica sand (Pre-mixed 100ml wet slip – 100g quartz) Phillips studio glass frit	
40g BC	Slip + 10g Frit	2Ii
40g BC	Slip + 15g Frit	2Iii
Firing range:	1260°C fully fired	
Firing cycle:	100°C /hr to 400°C 150°C /hr to 1260°C 0.15 min soak Skip 20°C end	
Glass Prog:	780°C	
	200°C /hr to 780°C	30 mins soak
	110°C /hr to 510°C	3hrs soak
	8°C /hr to 405°C	1hr soak
	16°C /hr to 250 °C	END

Observations: Porcelain cracked no issues with bone china bodies.

Suggestions: Porcelain not compatible


Test 2Ii


Test 2Iii

Materials Testing Phase 2:
Route 2J

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 2.6.8

Description: Round Tiles, Potterycrafts Clay bodies & glass frit

Number: 2Ji -2Jvi

Size: 80mm x 80mm

Material: Potterycrafts slip
Phillips studio glass 500 mesh frit

100ml Slip +	Bone China +20g frit	2J i
100ml Slip +	DL Porcelain +20g frit	2J ii
100ml Slip +	White earthenware throwing +20g frit	2J iii
100ml Slip +	White earthenware +20g frit	2J iv
100ml Slip +	Ivory earthenware +20g frit	2J v
100ml Slip +	Easy Cast Plastic +20g frit	2J vi

Firing range: 1280°C/1260°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Observations: Glass cracked, ranging from slight to severe cracking

Suggestions: Fire glass at glass schedule fire to 780/800°C

Image:

Test 2Ji

Test 2Jii

Test 2Jiii

Test 2Jiv

Test 2Jv

Test 2Jvi

Materials Testing Phase 2:
Route 2J

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 30.6.8

Description: Round Tiles, Potterycrafts Clay bodies

Number: 2Jvii -2Jxii

Size: 80mm x 80mm

Material: Potterycrafts slip
Phillips studio glass 500 mesh frit

100ml Slip +	Bone China +20g glass frit	2J vii
100ml Slip +	DL Porcelain +20g glass frit	2J viii
100ml Slip +	White earthenware throwing +20g glass frit	2J viiii
100ml Slip +	White earthenware +20g glass frit	2J x
100ml Slip +	Ivory earthenware +20g glass frit	2J xi
100ml Slip +	Easy Cast Plastic +20g glass frit	2J xii

Firing range: 1280°C/1260°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 800°C cast

Firing cycle:

100°C /hr to 790°C	1hr soak
100°C /hr to 510°C	3hr soak
6°C /hr to 296°C	
12°C /hr to 246°C	
25°C /hr to 100°C	END

Observations: Glass cracked, ranging from slight to severe

Suggestions: Fired glass at glass schedule to 790°C – however still cracked

Image:


Test 2Jvii


Test 2Jviii


Test 2Jviiii


Test 2Jx


Test 2Jxi


Test 2Jxii

Materials Testing Phase 2:
Route 2K

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 2.7.8

Description: Feather form, diamond cut – test artwork

Number: 2Ki – 2Kii

Size: 200mm x 60mm

Material: Standard Porcelain Slip (Valentines)
Phillips studio glass 500 mesh frit

200g	Porcelain +20g glass frit	2Ki
200g	Porcelain +40g glass frit	2Kii

Firing range: 1280°C fully fired

Firing cycle: 100°C hr to 400°C
150°C hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 790°C cast

Firing cycle:

100°C /hr to 790°C	1hr soak
100°C /hr to 510°C	3hr soak
6°C /hr to 296°C	
12°C /hr to 246°C	
25°C /hr to 100°C	END

Observations: Glass cracked

Suggestions: Balance COE

Image:

Test 2Ki

Test 2Kii

Materials Testing Phase 2:
Route 2L

Title:	The combination of a (high fired) ceramic setter with glass frit	
Date:	2.7.8	
Description:	Feather form – test artwork	
Number:	2Li – 2Lii	
Size:	200mm x 60mm	
Material:	Standard Porcelain Slip (Valentines) Phillips studio glass 500 mesh frit	
250g	Porcelain +35g frit	2Li
250g	Porcelain +50g frit	2Lii
Firing range:	1280°C fully fired	
Firing cycle:	100°C hr to 400°C 150°C hr to 1280°C/1260°C 0.15 min soak Skip 20°C end	
Glass Prog:	790°C cast	
Firing cycle:	100°C /hr to 790°C	1hr soak
	100°C /hr to 510°C	3hr soak
	6°C /hr to 296°C	
	12°C /hr to 246°C	
	25°C /hr to 100°C	END

Observations: Glass cracked

Suggestions: Balance COE

Image:


Test 2Li


Test 2Lii

Materials Testing Phase 2:
Route 2M

Title: The combination of a (high fired) ceramic setter with glass frit

Date: 30.7.8

Description: Round Tiles

Number: 2Mi -2Mxii

Size: 80mm x 80mm
Material: Pottery Crafts Bone China (B), Spode Bone China (BC) & Valentines Porcelain (P) + Quartz
Phillips studio glass 500 mesh frit

100ml Slip +		
	Bone China (B) +20g frit+25g quartz	2Mi
	Bone China (B) +20g frit+50g quartz	2Mii
	Bone China (B) +20g frit+75g quartz	2Miii
	Bone China (B) +20g frit+100g quartz	2Miv
	Bone China (BC) +20g frit +25g quartz	2Mv
	Bone China (BC) +20g frit +50g quartz	2Mvi
	Bone China (BC) +20g frit +75g quartz	2Mvii
	Bone China (BC) +20g frit +100g quartz	2Mviii
	Porcelain (P) +20g frit +25g quartz	2Mviiii
	Porcelain (P) +20g frit +50g quartz	2Mx
	Porcelain (P) +20g frit +75g quartz	2Mxi
	Porcelain (P) +20g frit +100g quartz	2Mxii

Firing range: 1280°C/1260°C fully fired
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 790°C Cast

Firing cycle:		
	100°C /hr to 790°C	1hr soak
	100°C /hr to 510°C	3hr soak
	6°C /hr to 296°C	
	12°C /hr to 246°C	
	25°C /hr to 100°C	END

Observations: Glass cracked, ranging from slight to severe cracking, Tests 2Mvii & 2Mviii has the least cracking; which suggests optimum mix and body.

Suggestions: Select Bone China (B) as compatible body with quartz addition

Image:


Test 2Mi


Test 2Mii


Test 2Miii


Test 2Miv


Test 2Mv


Test 2Mvi


Test 2Mvii


Test 2Mviii


Test 2Mviiii


Test 2Mx


Test 2Mxi


Test 2Mxii

Materials Testing Phase 2: **Route 2N**

Title:	The combination of a (high fired) ceramic setter with glass frit
Date:	1.5.5 and 21.7.9
Description:	Honeycomb – Test artwork
Number:	2Ni -2Niii
Size:	100 x 60mm, 160 x 60mm, 120 x 60mm & 120 x 60mm
Material:	Standard Porcelain Slip (Valentines) Bone China (PotteryCrafts) Phillips studio glass 500 mesh frit/Glass cane

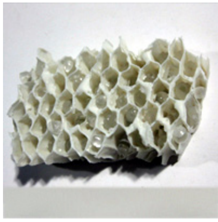
100ml Slip +	Porcelain +20g frit	2Ni
150ml Slip +	Porcelain +30g frit	2Nii
100ml Slip +	Bone China +20g frit	2Niii
100ml Slip +	Bone China +30g frit	2Niv

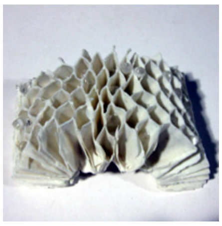
Firing range:	1280°C/1260°C fully fired
Firing cycle:	100°C hr to 400°C 150°C hr to 1280°C/1260°C 0.15 min soak Skip 20°C end
Glass Prog:	705°C Fuse

Firing cycle:	100°C /hr to 705°C	1hr soak
	100°C /hr to 510°C	3hr soak
	6°C /hr to 296°C	
	12°C /hr to 246°C	
	25°C /hr to 100°C	END

Observations:	No issues
Suggestions:	

Image:


Test 2Ni


Test 2Nii


Test 2Niii

Materials Testing Phase 2
Route 3D

Title: The combination of kiln glass with ceramic frit

Date: 26.05.09

Number: 3Div

Description: Hot Glass form & fused aggregate

Size: 60mm x 40mm Blown

Material: Bone China aggregate + Quartz (Pre-mixed 100ml wet slip – 100g quartz)
Phillips studio glass

3Di 200g Blown glass + 10g Glass Frit mesh 500 & 100g ceramic aggregate

Glass Prog: 705°C Fuse

Firing cycle:

75°C /hr to 510°C	
200°C /hr - 705°C	15min soak
250°C /hr to 510°C	3hr soak
8°C /hr to 405°C	
16°C /hr to 250°C	Off

Observations:

No issues - compatible

Suggestions:

Image:

Test 3Div

Materials Testing Phase 2:
Route 3E

Title:	The combination of kiln glass with ceramic frit
Date:	14.7.9
Number:	3Eii
Description:	'Emergence' blown glass form with fused aggregate – Test artwork
Size:	100mm x 60mm
Material:	High fired Bone china + Quartz (Pre-mixed 100ml wet slip – 100g quartz) Phillips studio glass
4Ei	40g Blown glass + 25g ceramic & glass frit
Firing range:	1260°C fully fired
Firing cycle:	100°C /hr to 400°C 150°C /hr to 1260°C 0.15 min soak Skip 20°C end
Firing range:	705°C
Glass Prog:	705°C Fuse Pâte de verre
Firing cycle:	75°C /hr to 510°C 200°C /hr - 705°C 15min soak 250°C /hr to 510°C 3hr soak 8°C /hr to 405°C 16°C /hr to 250°C Off

Observations:

Fine, no issues

Suggestions:

Image:

Test 3Eii

Materials Testing Phase 2:
Route 3F

Title: The combination of kiln glass with ceramic frit

Date: 14.7.9

Description: Cast glass petal form and aggregate – test artwork

Number: 3Fi-3Fiii

Size: 200 x 60mm

Material: Valentines Porcelain (P), PotteryCrafts Bone China (B), Spode Bone China (BC)
Phillips studio glass 500 mesh frit
Quartz (Pre-mixed 500ml wet slip – 500g quartz)

50g Pre-fired Ceramic aggregate (B) +400g frit	3Fi
50g Pre-fired Ceramic aggregate (P) +400g frit	3Fii
50g Pre-fired Ceramic aggregate (BC) +400g frit	3Fiii

Firing range: 1280°C/1260°C fully fired

Firing cycle: 100°C hr to 400°C
150°C hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 890°C Cast

Firing cycle: (Phillips)

100°C /hr to 890°C	4.5hrs soak
100°C /hr to 501°C	3hrs
6°C /hr to 296°C	
12°C /hr to 246°C	
24°C /hr to 100°C	END

Observations: Porcelain cracked, not compatible, Bone china bodies fine. (A little bit crumbly – use finer ceramic aggregate).

Suggestions:

Image:


Test 3Fi


Test 3Fii


Test 3Fiii

Materials Testing Phase 2:
Route 3G

Title: The combination of kiln glass with ceramic frit

Date: 20.7.9 & 23.7.9

Description: ‘Wedge’ form kiln cast glass and aggregate – Test artwork

Number: 3Gi-3Gvi

Size: 120 x 100mm
Material: PotteryCrafts Bone China (B) Quartz (Pre-mixed 100ml wet slip – 100g quartz)
Gaffer casting frit (White, Steel Blue & Copper Blue)

30g Pre-fired Ceramic aggregate +300g white glass frit	3Gi
30g Pre-fired Ceramic aggregate +300g white glass frit	3Gii
30g Pre-fired Ceramic aggregate +300g Steel blue glass frit	3Giii
30g Pre-fired Ceramic aggregate +300g Steel blue glass frit	3Giv
30g Pre-fired Ceramic aggregate +300g Copper Blue glass frit	3Gv
30g Pre-fired Ceramic aggregate +300g Copper Blue glass frit	3Gvi

Firing range: 1260°C fully fired
Firing cycle: 100°C hr to 400°C
150°C hr to 1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 825°C Cast
Firing cycle:

100°C /hr to 825°C	1.5hrs soak
FULL /hr to 650°C	30mins soak (N.B to strike the white colour)
Full /hr to 450°C	1hr
20°C /hr to 440°C	3hr
7°C /hr to 330°C	
14°C /hr to 280°C	
160°C /hr to 24°C	END

Glass Prog: 650°C & 700°C Fuse
Firing cycle: 100°C /hr to 650°C/700°C 30mins soak

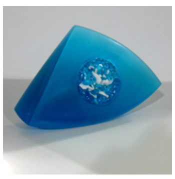
FULL /hr to 450°C	1hr soak
20°C /hr to 440°C	3hrs
7°C /hr to 330°C	
14°C /hr to 280°C	
160 /hr to 24°C	END

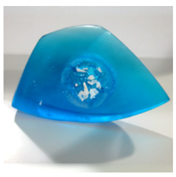
Observations: Tried to cast white without mould to see if mould was needed – didn’t work
No other issues – compatible, prefer higher fuse cast at 700°C
Suggestions: Always use mould. White glass didn’t fire very nicely – use clear instead.

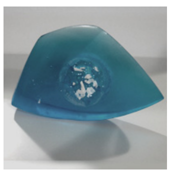
Image:

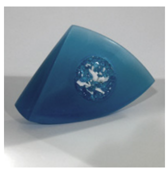

Test 3Gi


Test 3Gii


Test 3Giii


Test 3Giv


Test 3Gv


Test 3Gvi

Materials Testing Phase 2:
Route 3H

Title: The combination of kiln glass with ceramic frit

Date: 23.7.9

Description: Large round form kiln cast glass and aggregate – Test artwork

Number: 3Hi

Size: 200 x 260mm
Material: PotteryCrafts Bone China (B) + Quartz (Pre-mixed 100ml wet slip – 100g quartz)
Gaffer casting frit (Steel Blue)

50g Pre-fired Ceramic aggregate +3000g frit 3Hi

Firing range: 1260°C fully fired

Firing cycle: 100°C /hr to 400°C
150°C /hr to 1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 825°C Cast

Firing cycle:

100°C /hr to 825°C	1.5hrs soak
Full /hr to 450°C	1hr
20°C /hr to 440°C	3hr
7°C /hr to 330°C	
14°C /hr to 280°C	
160°C /hr to 24°C	END

Observations: No issues – compatible

Suggestions:

Image:

Test 3Hi

Materials Testing Phase 2:
Route 3I

Title: The combination of kiln glass with ceramic frit

Date: 14.7.9

Description: Kiln cast glass egg form and aggregate

Number: 3Ii-3Ivi

Size: 50 x 60mm

Material: Valentines Porcelain (P), PotteryCrafts Bone China (B), Spode Bone China (BC)
Phillips studio glass 500 mesh frit, Gaffer casting frit
Quartz (Pre-mixed 100ml wet slip – 100g quartz)

10g Pre-fired Ceramic aggregate (B) +150g frit	3Ii
10g Pre-fired Ceramic aggregate (B) +150g frit	3Iii
10g Pre-fired Ceramic aggregate (P) +150g frit	3Iiii
10g Pre-fired Ceramic aggregate (P) +150g frit	3Iiv
10g Pre-fired Ceramic aggregate (BC) +150g frit	3Iv
10g Pre-fired Ceramic aggregate (BC) +150g frit	3Ivi

Firing range: 1280°C/1260°C fully fired
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1280°C/1260°C
0.15 min soak
Skip 20°C end

Glass Prog:	890°C Cast	
Firing cycle:	100°C to 890°C	4.5hrs soak
(Gaffer)	FULL /hr to 450°C	1hr 30mins soak
	20°C /hr to 440°C	4hrs
	4°C /hr to 312°C	
	18°C /hr to 262°C	
	43°C /hr to 24°C	END

Firing cycle:	100°C /hr to 890°C	4.5hrs soak
(Phillips)	100°C /hr to 501°C	3hrs
	6°C /hr to 296°C	
	12°C /hr to 246°C	
	24°C /hr to 100°C	END

Observations: Porcelain cracked Test 3Iiii & 3Iiv, not compatible, Bone china bodies ok.
Suggestions:

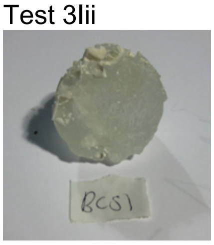
Image:

Test 3Ii

Test 3Iii

Test 3Iiii

Test 3Iiv



Test 3Iv

Test 3Ivi

Materials Testing Phase 2:
Route 3J

Title: The combination of kiln glass with ceramic frit

Date: 23.8.9

Description: Large round form kiln cast glass and aggregate – Test artwork

Number: 3Ji

Size: 120 x 100mm
Material: PotteryCrafts Bone China (B) + Quartz (Pre-mixed 100ml wet slip – 100g quartz)
Gaffer casting frit (Steel Blue)

30g Pre-fired Ceramic aggregate +300g frit 3Ji

Firing range: 1260°C fully fired

Firing cycle: 100°C hr to 400°C
150°C hr to 1260°C
0.15 min soak
Skip 20°C end

Glass Prog: 825°C Cast

Firing cycle:

100°C to 825°C	1.5hrs soak
Full /hr to 650°C	30mins (N.B to strike the white colour)
Full /hr to 450°C	1hr
20°C /hr to 440°C	3hr
7°C /hr to 330°C	
14°C /hr to 280°C	
160°C /hr to 24°C	END

Observations: No issues – compatible

Suggestions:

Image:

Test 3Ji

Materials Testing Phase 2
Route 4F

Title: The combination of ceramic elements encapsulated with hot glass

Date: 15.07.09

Description: Fully fired ceramic inclusions heated and hot cast within hot glass

Number: 4Fi & 4Fvii

Size: 100mm x 100mm hot cast glass blocks
150 x 150mm blown glass balls

Material: High fired Porcelain + Quartz Silica Sand (Pre-mixed 100ml wet slip – 100g quartz)
High fired Bone China + Quartz Silica Sand (Pre-mixed 100ml wet slip – 100g quartz)
Phillips studio glass

425g Blown glass + 5g High Fired Bone China	4Fi
245g Blown glass + 5g High Fired Bone China	4Fii
400g Blown glass + 5g High Fired Porcelain	4Fiii
225g Blown glass + 5g High Fired Porcelain	4Fiv
400g Blown glass + 10g High Fired Bone China	4Fv
1150g Blown glass + 10g High Fired Bone China	4Fvi
680g Blown glass + 5g High Fired Bone China (2nd test)	4Fvii
225g Blown glass + 10g High Fired Porcelain	4Fviii

Firing range: 1260/1280°C fully fired
Firing cycle: 100°C /hr to 400°C
150°C /hr to 1260/1280°C
0.15 min soak
Skip 20°C end
Pick up cycle: 150°C /hr to 600°C
200°C /hr to 800°C

Annealing range: 520°C
Annealing cycle:

down /hr to 520°C	30min soak
5°C /hr to 510°C	2hr soak
30°C /hr to 300°C	Off

Observations: Bone china – no issues, Porcelain - No visible issues, however under polarimeter shows stress

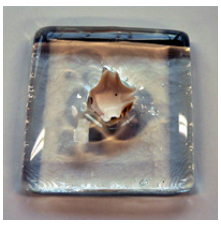
Suggestions: Select Bone china as compatible body, Porcelain not suitable

Image:


Test 4Fi


Test 4Fii


Test 4Fiii


Test 4Fiv


Test 4Fv


Test 4Fvi


Test 4Fvii


Test 4Fviii

Materials Testing Phase 2
Route 4G

Title: The combination of ceramic elements encapsulated with hot glass

Date: 15.07.09

Description: Fully fired bone china 'Flower' inclusions heated and hot cast within hot glass

Number: 4Gi & 4Gv

Size: 100mm x 100mm cast glass blocks
150 x 150mm blown balls

Material: High fired Spode Bone China (Readymade flowers)
Phillips studio glass
High fired Bone China + Quartz (Pre-mixed 100ml wet slip – 100g quartz) Test 4Gv
Phillips studio glass

425g Blown glass + 5g High Fired Bone China	4Gi
245g Blown glass + 5g High Fired Bone China	4Gii
400g Blown glass + 5g High Fired Bone China	4Giii
225g Blown glass + 5g High Fired Bone China	4Giv
400g Blown glass + 10g High Fired Bone China+ Quartz	4Gv

Firing range:	1260°C fully fired	
Firing cycle:	100°C /hr to 400°C	
	150°C /hr to 1260°C	
	0.15 min soak	
	Skip 20°C end	
Pick up cycle:	150°C /hr to 600°C	
	200°C /hr to 800°C	
Annealing range:	520°C	
Annealing cycle:	down to 520°C	30min soak
	5°C /hr to 510°C	2hr soak
	30°C /hr to 300°C	Off

Observations: Spode Bone china – visible cracks. Test 4Gv Spode Bone china + Quartz – No visible issues, however under polarimeter shows stress.
Suggestions: Not suitable (Tests conducted for Dixon Case Study, see section 5.7).

Image:


Test 4Gi


Test 4Gii


Test 4Giii


Test 4Giv


Test 4Gv

Materials Testing Phase 2
Route 4H

Title: The combination of ceramic elements encapsulated with hot glass

Date: 20.08.09

Description: Fully fired bone china 'Flower' inclusions heated and hot cast within hot glass

Number: 4Hi & 4Hv

Size: Blown glass bowls
Blown glass paperweight

Material: High fired Bone China + Quartz (Pre-mixed 100ml wet slip – 100g quartz)
Phillips studio glass

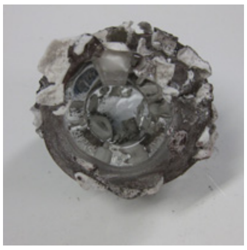
Blown glass + 15g High Fired Bone China Inclusion	4Hi
Blown glass + 15g High Fired Bone China Inclusion	4Hii
Blown glass + 15g High Fired Bone China Inclusion	4Hiii
Blown glass + 15g High Fired Bone China Inclusion	4Hiv
Blown glass + 15g High Fired Bone China Core	4Hv

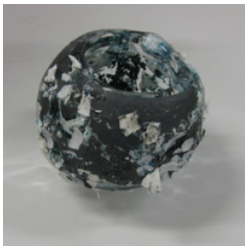
Firing range:	1260°C fully fired	
Firing cycle:	100°C /hr to 400°C	
	150°C /hr to 1260°C	
	0.15 min soak	
	Skip 20°C end	
Pick up cycle:	150°C /hr to 600°C	
	200°C /hr to 800°C	
Annealing range:	520°C	
Annealing cycle:	down to 520°C	30min soak
	5°C /hr to 510°C	2hr soak
	30°C /hr to 300°C	Off

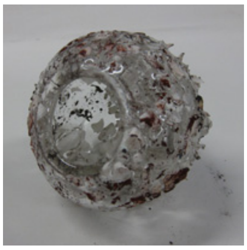
Observations: No visible issues,
Suggestions:

Image:


Test 4Hi


Test 4Hii


Test 4Hiii


Test 4Hiv


Test 4Hv

Appendix 6: Materials Testing Table Phase 1 & 2

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
1A i	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 1000 mesh	100ml/100g 20g	1280
1A ii	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 1000 mesh	100ml/100g 15g	1280
1A iii	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 1000 mesh	100ml/100g 10g	1280
1A iiii	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 500 mesh	100ml/100g 20g	1280
1A v	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 500 mesh	100ml/100g 15g	1280
1A vi	12.03.05	**1**	H/Fired Square Test Tile	4 x 4	Green unfired V Porcelain slip Phillips Frit 500 mesh	100ml/100g 10g	1280
1 A viii	20.06.05	**1**	High fired Tear form	20 x 12	Green unfired V Porcelain slip Phillips Frit 1000 mesh	320g 80g	1280
1 A viiii	20.06.05	**1**	High fired Triangle form & Rice	14 x 13	Green unfired V Porcelain slip Phillips Frit 1000 mesh	60g 20g	1280
2A i	17.3.5	**2**	H/Fired Square Test Tile (wheel cut pattern 1)	10x10	High fired V Porcelain Phillips Frit	100ml/40g 20g	1280
2A ii	17.3.5	**2**	H/Fired Square Test Tile (wheel cut pattern 2)	10x10	High fired V Porcelain Phillips Frit	100ml/40g 20g	1280
2A iii	17.3.5	**2**	H/Fired Square Test Tile (wheel cut pattern 3)	10x10	High fired V Porcelain Phillips Frit	100ml/40g 20g	1280
2A iiii	17.3.5	**2**	H/Fired Square Test Tile (wheel cut pattern 4)	10x10	High fired V Porcelain Phillips Frit	100ml 20g	1280
2Bi	30.3.5	**2**	Stalactite form	10 x 12	Bisc. fired V Porcelain Phillips Frit	100ml/200g 30g	1000
2Bii	30.3.5	**2**	Stalactite form	10x 12	Bisc. fired V Porcelain Phillips Frit	100ml/200g 40g	1000
2Biii	30.3.5	**2**	Stalactite form	10 x 12	High fired V Porcelain Phillips Frit	100ml/200g 30g	1280
2Biiii	30.3.5	**2**	Stalactite form	10x 12	High fired V Porcelain Phillips Frit	100ml/200g 40g	1280

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
2Ci	27.5.8	**2**	Round Tile Valentines (B71C)	8 x 8	White Stoneware Philips Glass Frit	100ml 20g	1280
2Cii	27.5.8	**2**	Round Tile Potclays (1114M)	8 x 8	Premium Craft Crank Philips Glass Frit	100ml 20g	1280
2Ciii	27.5.8	**2**	Round Tile Scarva Pottery	8 x 8	Earthenstone (Stoneware) Philips Glass Frit	100ml 20g	1280
2Ciiii	27.5.8	**2**	Round Tile Valentines (SP)	8 x 8	SP Porcelain Philips Glass Frit	100ml 20g	1280
2Cv	27.5.8	**2**	Round Tile Valentines (B17C)	8 x 8	White Stoneware Crank Philips Glass Frit	100ml 20g	1280
2Cvi	27.5.8	**2**	Round Tile Valentines (BC)	8 x 8	Fine Bone China Philips Glass Frit	100ml 20g	1240
2Cvii	27.5.8	**2**	Round Tile Potclays (1149)	8 x 8	HF Porcelain Philips Glass Frit	100ml 20g	1280
2Cviii	27.5.8	**2**	Round Tile Potclays (1146)	8 x 8	Porcelain Philips Glass Frit	100ml 20g	1280
2Cviiii	27.5.8	**2**	Round Tile Potclays (1148)	8 x 8	Bone China Philips Glass Frit	100ml 20g	1240
2Cx	27.5.8	**2**	Round Tile Potclays (1151/1551)	8 x 8	Porcelain Southern Ice Philips Glass Frit	100ml 20g	1280
2Cxi	27.5.8	**2**	Round Tile Potclays (1150/1550)	8 x 8	Porcelain Cast Body Slip Philips Glass Frit	100ml 20g	1280
2Cxii	27.5.8	**2**	Round Tile Potclays (1447)	8 x 8	DL Porcelain Philips Glass Frit	100ml 20g	1280
2Cxiii	27.5.8	**2**	Round Tile Potclays (1200)	8 x 8	White Slip Philips Glass Frit	100ml 20g	1280
2Di	01.05.0 5	**2**	H/Fired slice form	12 x 4	High fired V Porcelain Phillips Frit	80ml/72.5g 2.5g	1280
2Dii	01.05.0 5	**2**	H/Fired slice form	12 x 4	High fired V Porcelain Phillips Frit	80ml/72.5g 5g	1280
2Ei	12.05.0 5	**2**	High fired slip trail setter frit & ceramic aggregate	12 x 8	High fired V Porcelain Phillips Frit	80ml/65g 5g	1280 650
2Eii	12.05.0 5	**2**	High fired slip trail setter frit & ceramic aggregate	13 x 9	High fired V Porcelain Phillips Frit	80ml/75g 10g	1280 650

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
3A i	6.05.05	**3**	Cast glass egg form & porcelain aggregate	5 x 6	Biscuit fired V Porcelain Phillips Frit	5ml/25g 190g	650
3B i	6.05.05	**3**	Kiln cast Boat form & porcelain aggregate	30 x 15	Biscuit fired V Porcelain Phillips Frit	50g 550g	1000 800
3B ii	6.05.05	**3**	Kiln cast Boat form & porcelain aggregate	30 x 15	Fully fired V Porcelain Phillips Frit	50g 550g	1000 800
3C i	6.05.05	**3**	Kiln cast Disc & porcelain aggregate	11x11	Fully fired V Porcelain Phillips Frit	80g 340g	1280 800
3D i	19.5.05	**3**	Glass Frit & Porcelain chips fused in hot glass form	6 x 4	High fired V Porcelain Phillips Hot Glass Phillips Frit	10g 200g 10g	1280 705
3D ii	19.5.05	**3**	Porcelain chips fused in hot glass form	8 x 10	High fired V Porcelain Phillips Hot Glass Phillips Frit	15g 620g 15g	1280 705
3D iii	19.5.05	**3**	Porcelain chips cast in hot glass form	12 x 12	High fired V Porcelain Phillips Hot Glass Phillips Frit	25g 750g 25g	1280 705
3Ei	29.5.05	**3**	Porcelain aggregate - 'Emergence' form fused in hot glass form	10 x 6	High fired V Porcelain & Glass Frit Phillips Hot Glass	10g 380g	1280 705
4A i	09.5.05	**4**	Egg Form enclosed in hot glass	5 x 8	Biscuit fired V Porcelain Phillips Hot Glass	20g 470g	1000 510
4A ii	09.5.05	**4**	Round Form enclosed in hot glass	8 x 8	Biscuit fired V Porcelain Phillips Hot Glass	20g 440g	1000 510
4B i	09.5.05	**4**	Egg form trailed in hot glass	5 x 8	Biscuit fired V Porcelain Phillips Hot Glass	50g 5g	1000 510
4C i	19.5.05	**4**	Porcelain discs enclosed in hot glass	5 x 8	High fired V Porcelain Phillips Hot Glass	30g 450g	1280 510
4C ii	19.5.05	**4**	Porcelain discs enclosed in hot glass	5 x 8	High fired V Porcelain Phillips Hot Glass	50g 450g	1280 510
4D i	19.5.05	**4**	Porcelain trails hot cast in hot glass open cast 1 layer	10 x 16	High fired V Porcelain Phillips Hot Glass	40g 880g	1280 510
4D ii	19.5.05	**4**	Porcelain trails hot cast in hot glass open cast 1 layer	10 x 16	High fired V Porcelain Phillips Hot Glass	20g 700g	1280 510
4E i	19.5.05	**4**	Porcelain aggregate 'Evolve' form cast in hot glass	20 x 26	High fired V Porcelain Phillips Hot Glass	100g 3000g	1280 510

Appendix 6: Materials Testing Phase 2

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
1Bi	27.5.8	**1**	A1 Round Tile	8 x 8	Green State Porcelain Slip	100ml	1280
			Diamond Cut		Quartz	10g	
					Philips Glass Frit	20g	
1Bii	27.5.8	**1**	A2 Round Tile	8 x 8	Green State Porcelain Slip	100ml	1280
			Diamond Cut		Quartz	7.5g	
					Philips Glass Frit	20g	
1Biii	27.5.8	**1**	A3 Round Tile	8 x 8	Green State Porcelain Slip	100ml	1280
			Diamond Cut		Quartz	5g	
					Philips Glass Frit	20g	
1Biiii	27.5.8	**1**	A4 Round Tile	8 x 8	Green State Porcelain Slip	100ml	1280
			Diamond Cut		Quartz	2.5g	
					Philips Glass Frit	20g	
1Ci	2.6.8	**1**	Round Tile Pottery Crafts (P1211)	8 x 8	Green State Bone China Slip	100ml	1280
					Philips Glass Frit	20g	
1Cii	2.6.8	**1**	Round Tile Pottery Crafts (P1221)	8 x 8	Green State DL Porcelain Slip	100ml	1280
					Philips Glass Frit	20g	
1Ciii	2.6.8	**1**	Round Tile Pottery Crafts (P1521)	8 x 8	Green State White Throwing E/W Slip	100ml	1280
					Philips Glass Frit	20g	
1Ciiii	2.6.8	**1**	Round Tile Pottery Crafts (P1240)	8 x 8	Green State White Earthenware Slip	100ml	1280
					Philips Glass Frit	20g	
1Cv	2.6.8	**1**	Round Tile Pottery Crafts (P1260)	8 x 8	Green State Ivory Earthenware Slip	100ml	1280
					Philips Glass Frit	20g	
1Cvi	2.6.8	**1**	Round Tile	8 x 8	Green State Porcelain Slip	100ml	1280
			Valentines		Philips Glass Frit	20g	
2Fi	27.5.8	**1**	B1 Round Tile	8 x 8	High Fired Porcelain	100ml	1280
			Diamond Cut		Quartz	100g	
					Philips Glass Frit	20g	
2Fii	27.5.8	**1**	B2 Round Tile	8 x 8	High Fired Porcelain	100ml	1280
			Diamond Cut		Quartz	75g	
					Philips Glass Frit	20g	
2Fiii	27.5.8	**1**	B3 Round Tile	8 x 8	High Fired Porcelain	100ml	1280
			Diamond Cut		Quartz	50g	
					Philips Glass Frit	20g	
2Fiii	27.5.8	**1**	B4 Round Tile	8 x 8	High Fired Porcelain	100ml	1280
			Diamond Cut		Quartz	25g	
					Philips Glass Frit	20g	

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
2Gi	6.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Gaffer Copper Blue Frit	2g	750
2Gii	1.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Gaffer Copper Blue Frit	2g	725
2Giii	6.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Float Compatible Red Frit	2g	750
2Giiii	1.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Float Compatible Red Frit	2g	725
2Gv	6.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Phillips Frit	2g	750
2Gvi	1.5.9	**2**	High fired flower	3 x 3	High fired Spode Bone China	5g	1250
					Phillips Frit	2g	725
2Hi	14.7.9	**2**	High fired egg box form & cellulose	4 x 4	High fired Bone China & Quartz	5g	1260
					Phillips Frit	5g	780
2Hii	14.7.9	**2**	High fired egg box form & cellulose	4 x 4	High fired Porcelain & Quartz	5g	1280
					Phillips Frit	5g	780
2Hiii	14.7.9	**2**	High fired egg box form & cellulose	4 x 4	High fired Spode Bone China & Quartz	5g	1260
					Phillips Frit	5g	780
2Ii	30.7.9	**2**	High fired ball & cellulose	7 x 7	High fired Bone China & Quartz	40g	1260
					Phillips Frit	10g	780
2Iii	30.7.9	**2**	High fired ball & cellulose	7 x 7	High fired Bone China & Quartz	40g	5g BC
					Phillips Frit	15g	780
2Ji	2.6.8	**2**	Round Tile Pottery Crafts (P1211)	8 x 8	High Fired Bone China	100ml	1280
					Philips Glass Frit	20g	
2Jii	2.6.8	**2**	Round Tile Pottery Crafts (P1221)	8 x 8	High Fired DL Porcelain	100ml	1280
					Philips Glass Frit	20g	
2Jiii	2.6.8	**2**	Round Tile Pottery Crafts (P1521)	8 x 8	High Fired White Throwing E/W	100ml	1280
					Philips Glass Frit	20g	
2Jiv	2.6.8	**2**	Round Tile Pottery Crafts (P1240)	8 x 8	High Fired White Earthenware	100ml	1280
					Philips Glass Frit	20g	

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
2Jv	2.6.8	**2**	Round Tile Pottery Crafts (P1260)	8 x 8	High Fired Ivory Earthenware Philips Glass Frit	100ml 20g	1280
2Jvi	2.6.8	**2**	Round Tile Pottery Crafts (P1626)	8 x 8	Easy cast plastic Philips Glass Frit	100ml 20g	1280
2Jvii	30.6.8	**2**	Round Tile Pottery Crafts (P1211)	8 x 8	High Fired Bone China Philips Glass Frit	100ml 20g	1260 790
2Jviii	30.6.8	**2**	Round Tile Pottery Crafts (P1221)	8 x 8	High Fired DL Porcelain Philips Glass Frit	100ml 20g	1280 790
2Jviiii	30.6.8	**2**	Round Tile Pottery Crafts (P1521)	8 x 8	High Fired White Throwing E/W Philips Glass Frit	100ml 20g	1280 790
2Jx	30.6.8	**2**	Round Tile Pottery Crafts (P1240)	8 x 8	High Fired White Earthenware Philips Glass Frit	100ml 20g	1280 790
2Jxi	30.6.8	**2**	Round Tile Pottery Crafts (P1260)	8 x 8	High Fired Ivory Earthenware Philips Glass Frit	100ml 20g	1280 790
2Jxii	30.6.8	**2**	Round Tile Pottery Crafts (P1626)	8 x 8	Easy cast plastic Philips Glass Frit	100ml 20g	1280 790
2Ki	2.7.8	**2**	Feather Form	20 x 6	Porcelain Philips Glass Frit	200g 20g	1280
2Kii	2.7.8	**2**	Feather Form	20 x 6	Porcelain Philips Glass Frit	200g 40g	1280
2Li	2.7.8	**2**	Asymmetric Form		Porcelain Philips Glass Frit	250g 35g	1280
2Lii	2.7.8	**2**	Asymmetric Form		Porcelain Philips Glass Frit	250g 50g	1280
2Mi	30.7.8	**1**	B1 Round Tile	10 x 10	High fired Bone China Quartz Glass Frit	100ml 25g 20g	1260 790
2Mii	30.7.8	**1**	B2 Round Tile	10 x 10	High fired Bone China Quartz Glass Frit	100ml 50g 20g	1260 780
2Miii	30.7.8	**1**	B3 Round Tile	10 x 10	High fired Bone China Quartz Glass Frit	100ml 75g 20g	1260 780

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
2Miiii	30.7.8	**1**	B4 Round Tile	10 x 10	High fired Bone China	100ml	1260
					Quartz	100g	
					Glass Frit	20g	780
2Mv	30.7.8	**1**	BC1 Round Tile	10 x 10	High fired Bone China	100ml	1260
					Quartz	25g	
					Glass Frit	20g	790
2Mvi	30.7.8	**1**	BC2 Round Tile	10 x 10	High fired Bone China	100ml	1260
					Quartz	50g	
					Glass Frit	20g	780
2Mvii	30.7.8	**1**	BC3 Round Tile	10 x 10	High fired Bone China	100ml	1260
					Quartz	75g	
					Glass Frit	20g	780
2Mviii	30.7.8	**1**	BC4Round Tile	10 x 10	High fired Spode Bone China	100ml	1260
					Quartz	100g	
					Glass Frit	20g	780
2Mviiii	30.7.8	**1**	P1 Round Tile	10 x 10	High fired Porcelain	100ml	1280
					Quartz	25g	
					Glass Frit	20g	790
2Mx	30.7.8	**1**	P2 Round Tile	10 x 10	High fired Porcelain	100ml	1280
					Quartz	50g	
					Glass Frit	20g	780
2Mxi	30.7.8	**1**	P3 Round Tile	10 x 10	High fired Porcelain	100ml	1280
					Quartz	75g	
					Glass Frit	20g	780
2Mxii	30.7.8	**1**	P4Round Tile	10 x 10	High fired Porcelain	100ml	1280
					Quartz	100g	
					Glass Frit	20g	780
2Ni	01.05.05	**2**	H/Fired Honeycomb form & cellulose	10 x 6	High fired V Porcelain	100ml/180g	1280
					Phillips Frit	20g	750
2Nii	01.05.05	**2**	H/Fired Honeycomb form & cellulose	16 x 6	High fired V Porcelain	150ml/200g	1280
					Phillips Frit	30g	750
2Niii	21.7.9	**2**	H/Fired Honeycomb form & cellulose	12 x 6	High fired Bone China	100ml	1250
					Phillips Frit	20g	750
3D iv	26.05.09	**3**	Bone China + Quartz chips cast in hot glass form	6 x 4	High fired Bone China + Quartz	10g	1260
					Phillips Hot Glass	200g	725
					Phillips Frit	10g	

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
3Eii	14.7.9	**3**	Bone China & Glass frit paste	10 x 6	Fully fired Bone China & Quartz	25g	1260
			in hot glass ring		Phillips Hot Glass	40g	705
3Fi	14.7.9	**3**	Cast glass Petal form & bone china & quartz aggregate	20 x 6	Fully fired Bone China & Quartz	50g	1260
					Phillips Frit	400g	890
3Fii	14.7.9	**3**	Cast glass Petal form & Porcelain & quartz aggregate	20 x 6	Fully fired Porcelain & Quartz	50g	1280
					Phillips Frit	400g	890
3Fiii	14.7.9	**3**	Cast glass Petal form & Bone China Spode & quartz aggregate	20 x 6	Fully fired Spode Bone & Quartz	50g	1260
					Phillips Frit	400g	890
3Gi	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	White Gaffer	300g	650
					Fully fired Bone China & Quartz & Frit	30g	1260
3Gii	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	White Gaffer	300g	700
					Fully fired Bone China & Quartz & Frit	30g	1260
3Giii	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	Cobalt Blue Gaffer	300g	650
					Fully fired Bone China & Quartz & Frit	30g	1260
3Giiii	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	Cobalt Blue Gaffer	300g	700
					Fully fired Bone China & Quartz & Frit	30g	1260
3Gv	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	Steel Blue Gaffer	300g	650
					Fully fired Bone China & Quartz & Frit	30g	1260
3Gvi	23.7.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	Steel Blue Gaffer	300g	700
					Fully fired Bone China & Quartz & Frit	30g	1260
3Hi	23.7.9	**3**	Cast Glass Large Round form & bone china & quartz aggregate	20 x 26	Steel Blue Gaffer	3000g	825
					Fully fired Bone China & Quartz & frit	50g	1260
3I i	14.7.9	**3**	Cast glass egg form & bone china & quartz aggregate	5 x 6	Fully fired Bone China & Quartz	10g	1260
					Phillips Frit	150g	890
3I ii	14.7.9	**3**	Cast glass egg form & bone china & quartz aggregate	5 x 6	Fully fired Bone China & Quartz	10g	1260
					Gaffer Casting Frit	150g	890

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
3I iii	14.7.9	**3**	Cast glass egg form & Porcelain & quartz aggregate	5 x 6	Fully fired Porcelain & Quartz	10g	1280
					Phillips Frit	150g	890
3I iv	14.7.9	**3**	Cast glass egg form & Porcelain & quartz aggregate	5 x 6	Fully fired Porcelain & Quartz	10g	1280
					Gaffer Casting Frit	150g	890
3I v	14.7.9	**3**	Cast glass egg form & Bone China Spode & quartz aggregate	5 x 6	Fully fired Spode Bone & Quartz	10g	1260
					Phillips Frit	150g	890
3I vi	14.7.9	**3**	Cast glass egg form & Bone China Spode & quartz aggregate	5 x 6	Fully fired Spode Bone & Quartz	10g	1260
					Gaffer Casting Frit	150g	890
3Ji	23.8.9	**3**	Cast Glass Wedge form & bone china & quartz aggregate	12 x 10	Steel Blue / Clear /white Gaffer frit	300g	700
					Fully fired Bone China & Quartz	30g	1260
4Fi	15.7.9	**4**	Square tile Bone China inclusions hot cast in hot glass, sandwiched 2 layers	10 x 10	High fired Bone China + Quartz	5g	1260
					Phillips Hot Glass	425g	510
4Fii	15.7.9	**4**	Square tile Bone China inclusions hot cast in hot glass, open cast 1 layer	10 x 10	High fired Bone China + Quartz	5g	1260
					Phillips Hot Glass	245g	510
4Fiii	15.7.9	**4**	Square tile Porcelain inclusions hot cast in hot glass, sandwiched 2 layers	10 x 10	High fired Porcelain + Quartz	5g	1280
					Phillips Hot Glass	400g	510
4Fiiiii	15.7.9	**4**	Square tile Porcelain inclusions hot cast in hot glass, open cast 1 layer	10 x 10	High fired Porcelain + Quartz	5g	1280
					Phillips Hot Glass	225g	510
4Fv	15.7.9	**4**	Round form Bone China inclusions blown in hollow hot glass,	15 x 15	High fired Bone China + Quartz	10g	1260
					Phillips Hot Glass	400g	510
4Fvi	15.7.9	**4**	Round form Bone China inclusions blown in solid hot glass	15 x 15	High fired Bone China + Quartz	10g	1260
					Phillips Hot Glass	1150g	510
4Fvii	23.7.9	**4**	Square tile Bone China inclusions hot cast in hot glass, sandwiched 2 layers	10 x 10	High fired Bone China + Quartz	5g	1260
					Phillips Hot Glass	680g	510

Number	Date	Process Route	Description	Size (cm)	Materials used	Amount	Firing Range °C
4Fviii	15.7.9	**4**	Round form Porcelain inclusions blown in hollow hot glass,	15 x 15	High fired Porcelain + Quartz	10g	1280
					Phillips Hot Glass	1100g	510
4Gi	15.7.9	**4**	Square tile Bone China flowers hot cast in hot glass, sandwich cast 2 layers	10 x 10	Spode Bone China	5g	1250
					Phillips Hot Glass	460g	510
4Gii	15.7.9	**4**	Square tile Bone China flowers hot cast in hot glass, open cast 1 layer	10 x 10	Spode Bone China	5g	1250
					Phillips Hot Glass	220g	510
4Giii	15.7.9	**4**	Round form Bone China flowers blown in hollow hot glass (with bone china + quartz inclusion on left)	15 x 15	Spode Bone China	10g	1250
					Phillips Hot Glass	1290g	510
4Giiii	15.7.9	**4**	Round form Bone China flowers blown in solid hot glass	15 x 15	Spode Bone China	10g	1250
					Phillips Hot Glass	1005g	510
4Gv	23.7.9	**4**	Square tile Bone China + quartz flowers hot cast in hot glass, sandwich cast 2 layers	10 x 10	Spode Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510
4Hi	20.8.9	**4**	Bone China + quartz inclusions + Copper carbonate encapsulated in hot blown glass	10 x 10	Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510
					Copper carbonate	2g	
4Hii	20.8.9	**4**	Bone China + quartz inclusions + Copper oxide encapsulated in hot blown glass	10 x 10	Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510
					Copper oxide	2g	
4Hiii	20.8.9	**4**	Bone China + quartz inclusions + Iron oxide encapsulated in hot blown glass	10 x 10	Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510
					Iron oxide	2g	
4Hiv	20.8.9	**4**	Bone China + quartz inclusions + Red Iron oxide encapsulated in hot blown glass	10 x 10	Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510
					Red Iron oxide	2g	
4Hv	20.8.9	**4**	Bone China + quartz inclusions encapsulated in hot solid glass	10 x 10	Bone China + Quartz	5g	1260
					Phillips Hot Glass	585g	510

Appendix 7: Suitable Clay Bodies

Supplier Reference	Clay Body	Supplier	Application	Bisc. Temp °C	High Fired Temp °C	Firing Range °C	Texture: 1 – smooth 10 – coarse FiredColour
P1211	**Bone China**	**PotteryCrafts**	Casting, machine making, flower making, fine sculpture	**1060**	**1250**	**1230 - 1250**	**1 White / Translucent**
P1221	**David Leach Trad. Porcelain**	**PotteryCrafts**	Throwing, casting, machine making, flower making, fine sculpture	**1060**	**1270**	**1240 - 1270**	**1 White / Translucent**
P1240	**White Earthenware**	**PotteryCrafts**	Throwing, casting, machine making, coiling, hand building	**1060**	**1180**	**1120 - 1180**	**1 White**
P1260	**Ivory Earthenware**	**PotteryCrafts**	Throwing, casting, machine making, coiling, hand building	**1060**	**1180**	**1120 - 1180**	**1 Creamy / Grey White**
P1521	**White Throwing Earthenware**	**PotteryCrafts**	Throwing, machine making, coiling, casting, modelling, hand building	**1060**	**1180**	**1080 - 1180**	**3 White**
N/A	**Earthenstone (Stoneware)**	**Scarva Pottery Supplies**	Small proportion molochite, suitable for throwing, press moulding and slab building	**1060**	**1280**	**1180-1280**	**White firing**
1141-30	**Grogged White Stoneware**	**Potclays**	White-burning, refractory, smooth-textured body which throws and handles well.	**1060**	**1280**	**1220 - 1280**	**White firing**
1114 M	**Premium Craft Crank**	**Potclays**	Handbuilding large items with other clays provides 'tooth' coarse textured open clay but plastic. Low shrinkage.	**1060**	**1280**	**1220 - 1280**	**Toasted (speckled orange-brown reduction)**
1446	**Porcelain**	**Potclays**	White, suitable for casting.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
1447	**DL Porcelain**	**Potclays**	Whiter and more plastic than 1146 Throwing.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
1148	**Bone China**	**Potclays**	Figurines, flowers etc. And prestige items. Casting.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
1149	**HF Porcelain**	**Potclays**	Strong, finest quality and value. Throws well. Consistent and reliable	**1060**	**1280**	**1220 - 1280**	**White & Translucent**

Supplier Reference	Clay Body	Supplier	Application	Bisc. Temp °C	High Fired Temp °C	Firing Range °C	Texture: 1 – smooth 10 – coarse FiredColour
1550/1150	**Porcelain Cast Body Slip**	**Potclays**	White, suitable for casting.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
1151/1551	**Southern Ice**	**Potclays**	White, suitable for casting.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
1200	**White Slip**	**Potclays**	Off white, suitable for casting.	**1060**	**1160**	**1040 - 1160**	**White/Ivory**
B17C	**White S/Ware**	**Valentines**	Blend of selected low iron clays Silica sand inc. excellent for throwing Ideal for a decorative SW ceramics.	**1060**	**1280**	**1220 - 1280**	**Pale Buff**
B17C	**White S/Ware Crank**	**Valentines**	Same as above but with addition of mesh graded dust free grogg	**1060**	**1280**	**1220 - 1280**	**Pale Buff**
N/A	**S.P. Porcelain**	**Valentines**	High quality porcelain contains finer white clays with a Bentonite addition. Modelling, hand building and casting.	**1060**	**1280**	**1220 - 1280**	**White & Translucent**
N/A	**Fine Bone China**	**Valentines**	Used by Bone China manufacturers. Casting and machine making.	**1060**	**1240**	**38 ring - 1240**	**White & Translucent**

Appendix 8: General materials used

Appendix 8: Materials used & Supplier Information

1. S.P Porcelain
2. Bone China
3. Quartz
4. Pottery Crafts Clays
5. Potclays Clays
6. Scarva Clays
7. Valentines Clays
8. Philips Furnace Glass
9. Gaffer Glass

1. S.P Porcelain

Valentine Clays Ltd. The Sliphouse, 18-20 Chell Street, Hanley, Stoke-on-Trent ST1 6BA
Tel: +44 (0)1782 271200 Fax: +44 (0)1782 280008
www.valentineclays.co.uk sales@valentineclays.co.uk

SPECIAL PORCELAIN (Very Smooth)
A high quality porcelain which contains finer white clays with a Bentonite addition. Suitable for modelling, hand building and casting.
Firing: 1220 - 1280°C (White and translucent)

Data related to the Expansion rate of *Valentines* Special Porcelain

0.32% Porcelain	0.32 (Provided by supplier as a % expansion @500°C)
100 x 480	0-1000°C 69.0 x 10 $^{-7}$
Firing Range:	1240 - 1280°C

2. Bone China

Pottery Crafts Ltd Campbell Road, Stoke-on-Trent, Staffordshire ST4 4ET
Tel: +44 (0)1782 745000 Fax: +44 (0)1782 746000
sales@potterycrafts.co.uk www.potterycrafts.co.uk

BONE CHINA (P1211) (Smooth)
A Bone China which contains 25%China Clay, 25% Feldspar and 50% Calcined Bone Ash. Suitable for casting, machine making, flower making & fine sculpture.
Firing: 1220 - 1250°C (White and translucent)

Data related to Expansion rate of *Pottery Crafts* Bone China

0.41% Bone China	0.41 (Provided by supplier as a % expansion @500°C)
100 x 480	0-1000°C 85.4 x 10 $^{-7}$
Firing Range:	1230 - 1250°C

Campbell Road Stoke on Trent ST4 4ET
United Kingdom
Tel 01782 745000
Fax 01782 746000
http://www.potterycrafts.co.uk
sales@potterycrafts.co.uk

Potterycrafts LTD

CLAY TECHNICAL DATA

Product Reference **P1211 Bone China Body**

Fired Colour **Very White Translucent.**

Recommended Firing Temperature **1240 ° C (42 Bullers Ring)**

Fired Strength **1400 kg/ cm²**

Contraction %

Wet – Dry	-	4.3%
Dry - Fired	-	11.5%
Total	-	16.0%

Coefficient of thermal expansion (1240 ° C):

$\alpha_{20\text{-}500}$ **8.54 x 10^{-6} °C^{-1}**
0.41% @ 500 ° C

Oxide analysis:

SiO_2	-	34.3%
TiO_2	-	0.05%
Al_2O_3	-	13.2%
Fe_2O_3	-	0.28%
P_2O_5	-	24.0%
CaO	-	20.0%
MgO	-	0.67%
K_2O	-	1.54%
Na_2O	-	1.65%
L.O.I.	-	4.8%

Casting Slip Recipe

100 kgs Clay
360 gms Sodium Silicate
(100' s Twaddle)
12 Litres Water

Footnote
LIABILITY
Such information is the best of Potterycrafts Ltd' s knowledge and belief accurate at the date of publication, which is the date generated automatically on the day of printing of this document. However, no representation, warranty of guarantee is made as to its accuracy, reliability of completeness. It is the user's responsibility to satisfy itself as to the suitability and completeness of such information for their own particular use.
THIRD PARTY MATERIALS
Insofar as materials not manufactured or supplied by Potterycrafts Ltd are used in conjunction with, or instead of Potterycrafts Ltd materials, it is the responsibility of the customer itself to obtain from the manufacturer or supplier all technical data and other properties relating to

SOUTH EAST BRANCHES
Kings Yard Pottery, Talbot Road **Rickmansworth** Herts WD3 1HW Tel 01923 770127 Fax 01923 896202
8-10 Ingate Place **Battersea** London SW8 3NS Tel 020 7720 0050 Fax 020 7627 8290

3. Quartz

Pottery Crafts Ltd Campbell Road, Stoke-on-Trent, Staffordshire ST4 4ET
Tel: +44 (0)1782 745000 Fax: +44 (0)1782 746000
sales@potterycrafts.co.uk www.potterycrafts.co.uk

QUARTZ SILICA SAND (P3337) (Fine ground off white powder)

Potterycrafts LTD

Campbell Road Stoke on Trent ST4 4ET
United Kingdom
Tel 01782 745000
Fax 01782 746000
http://www.potterycrafts.co.uk
sales@potterycrafts.co.uk

Technical Data Sheet

Product P3337 Quartz Silica Sand

Appearance **Fine ground Off White Powder**

Chemical Analysis

SiO_2	:	98.0 - 98.5 %
Fe_2O_3	:	0.03 - 0.06 %
Al_2O_3	:	0.6 - 1.00 %
K_2O	:	0.3 - 0.60 %
Na_2O	:	0.05 - 0.1 %
Cr_2O_3	:	0.0007 - 0.0015%
Loss on Ignition	:	0.15 - 0.25 %

Finess

100 % passes	60 ' mesh sieve
99.9 % passes	100 ' mesh sieve
99.6 % passes	120 ' mesh sieve
99.3 % passes	150 ' mesh sieve
98.5 % passes	200 ' mesh sieve
95.0 % passes	300 'mesh sieve.

SOUTH EAST BRANCHES

Winton House, 2 Winton Approach Watford Road, Croxley Green	**Rickmansworth**	Herts WD3 3TL	Tel 01923 800006	Fax 01923 245544
8-10 Ingate Place	**Battersea**	London SW8 3NS	Tel 020 7720 0050	Fax 020 7627 8290

4. Pottery Crafts Clays

Pottery Crafts Ltd Campbell Road, Stoke-on-Trent, Staffordshire ST4 4ET
Tel: +44 (0)1782 745000 Fax: +44 (0)1782 746000
sales@potterycrafts.co.uk www.potterycrafts.co.uk

Bone China P1211
David Leach Trad. Porcelain P1221
Semi Porcelain P1230
White Earthenware P1240
Ivory Earthenware P1260
White Throwing Earthenware P1521
Easy Cast Plastic P1626

5. Potclays Clays

Potclays, Brickkiln Lane, Etruria Stoke-on-Trent, Staffordshire, ST4 7BP
Tel: +44 (0)1782 219816 Fax: +44 (0)1782 286506
sales@potclays.co.uk www.potclays.co.uk

Grogged White 1141-30 Stoneware
Premium Craft Crank 1114 M
Porcelain 1446
DL Porcelain 1447
Bone China 1148
HF Porcelain 1149
Porcelain Cast Body Slip 1550
Southern Ice 1151
White Slip 1200

6. Scarva Clays
Scarva Pottery Supplies, Unit 20, , Scarva Road Industrial Estate,
Banbridge, Co. Down,
Northern Ireland, BT32 3QD
Tel: +044(0)28 40669699 Fax: +044(0)28 40669700
www.scarvapottery.com david@scarvapottery.com

Earthenstone (Stoneware)

7. Valentines Clays

Valentine Clays Ltd. The Sliphouse, 18-20 Chell Street, Hanley, Stoke-on-Trent ST1 6BA
Tel: +44 (0)1782 271200 Fax: +44 (0)1782 280008
www.valentineclays.co.uk

White Stoneware (B71C)
White Stoneware Crank (B17C)
Bone China (BC)

8. Philips Furnace Glass

Glassworks Services Limited
Unit 8, Broomhouse Lane Ind Estate, New Edlington
Doncaster, DN12 1EQ, United Kingdom
Tel: +44 1709 770801 Fax: +44 1709 770803
www.glassworksservices.co.uk enquiries@glassworksservices.co.uk

Data related to Expansion rate of *Philips 3300* Furnace Glass

Expansion:	0-300°C 96.0 x 10^{-7} (Provided by supplier)
	25-400°C 100.0 x 10^{-7}
Anneal Point:	510°C
Strain Point:	470°C
Casting temperature:	750-800°C

9. Gaffer Glass
Gaffer Glass UK Ltd. Unit 36, Limberline Spur ind. Estate, Hilsea, Portsmouth, PO3 5DX.
Tel: +44 (0)23 9267 7674 Fax. +44 (0)23 9266 7654
gafferglass@btconnect.com www.gafferglass.co.uk

GAFFER CASTING GLASS (Coloured & Clear Billets & Frit)

GAFFER BLOWING GLASS (Coloured & Clear Rod, Frit & Powders)

Data related to Expansion rate of *Gaffer* Casting Glass

Expansion	20-300°C 92x10^{-7} (Provided by supplier)
Anneal Point:	440°C.
Strain point:	400°C.
Casting temperature:	**780-850°C**

Data related to Expansion rate of *Gaffer* Batch & Blowing Glass

Expansion:	0-300°C: 96.0 x 10^{-7} (Provided by supplier)
	25-300°C: 98.5 x 10^{-7}
Anneal Point:	486°C
Strain Point:	439°C

Appendix 9: A comparison of Bone China to Porcelain

Table 12 A comparison of Bone China to Porcelain

	Bone China	Porcelain
Composition	Bone Ash, Cornish Stone/China Clay, Quartz, Ball Clay.	Quartz, Potash Feldspar, China Clay, Ball Clay, Bentonite
Model & Mould Requirements	Certain forms require compensation curves at model stage.	Certain forms require compensation curves at model stage.
Casting	Casting times e.g. 2-3 min for 3mm thickness.	Casting times e.g. 2-3 min for 3mm thickness.
Firing Temp.	High biscuit 1250oC + 11/2 hrs soak Low Glaze 1000-1080oC	Low Biscuit 1000oC High Glaze 1260-1400oC For vitrified pieces requiring no glazing fire directly to this temp. (exceptions certain 1080oC glazes will adhere to high-fired therefore similar to bone china.)
Setting	Needs supporting or setting at high biscuit stage – not necessary at low glaze stage.	If no glaze is required & the pieces are fired straight to the top Temp., then setting needs to be applied in the same way as for bone china. If the pieces have been designed and produced with the least risk of warping, very little setting is needed, if at all, at the top temp. Cups and symmetrically rimmed pieces can be boxed, however the glaze needs to be wiped from the rim. Gum Arabic is used to adhere the two rims together during firing, After firing the rims are highly polished and sealed where there is no glaze. Grinding tools and solution of glaze as a lubricant.
Glazing	Due to Vitrification at the high biscuit stage, app. of glaze can be diff. Either heat the piece beforehand or add. 1-2% of gum Arabic to help with adhesion.	Glazing is straight forward as it is applied at the soft biscuit stage.
Qualities & Properties	Very white. Translucent. Hard. Applied colours appear cleaner and truer due to the white base.	Off white or colour in oxidised firing. Blue/grey colour in reduction firing. Not as translucent. Harder & stronger. Applied colours can appear duller.

Appendix 10: Artists Statement and CV

Jessamy Kelly

info@jessamykellyglass.com
www.jessamykellyglass.com

Artists Statement

Jessamy Kelly is a glass and ceramic artist, her studio work is based on the hand crafted sensitivity of craft practice. She uses techniques such as diamond cutting and engraving to shape and texture her sculptural work. She harnesses light by cutting away or manipulating the materials to reveal the inherent qualities of glass and ceramics. This approach creates a soft sensitive aesthetic which works subtly with the simplicity of her blown and cast glass forms and slip cast ceramics. She uses only clear glass and unglazed porcelain to emphasise the form and textures of her work. The way light passes through glass and ceramics to reveal an inner luminosity intrigues her and inspires her to combine these two mediums. Jessamy's work shows balance, precision and great delicacy. Working with simple forms to create a soft sensitive aesthetic, her sculptural glass and ceramics are inspired by organic and naturally repeating forms and draw inspiration from diverse natural forms, the local landscape and the human body. Her work has been exhibited widely throughout the UK as well as internationally in France, the Czech Republic, the Netherlands and in the United States.

Background

In 2001, Jessamy completed her Bachelor of Arts degree in 'Glass and Ceramics' at the University of Sunderland and went on to complete her Masters in 'Glass Design' at Edinburgh College of Art, in 2002. This involved an Industrial placement at Edinburgh Crystal as a student glass designer. This opportunity allowed her to develop a creative and experimental approach within the reality of a commercial environment. Jessamy worked as an in-house glass designer for Edinburgh Crystal until 2006, when she decided to focus completely on her own studio work and business. She continues to work on a freelance basis as a glass designer for industry; this collaboration informs and influences her studio work in a unique and innovative way. Jessamy has run her own art glass business 'Jessamy Kelly Glass' since graduating in 2001 and went on to set up Juo Ltd with designer Joanne Mitchell in July 2006. Juo Ltd is a contemporary art glass brand that produces fused glass wall panels; both businesses are currently based at the National Glass Centre, in Sunderland. In 2009 she completed her practice based PhD (part-time) at the University of Sunderland. This postgraduate research examines the combination of glass and ceramics in a hot state, within her studio practice as a means of artistic expression. The research offers a potential new route of practice for artists working in glass and ceramics.

Jessamy Kelly

Curriculum Vitae

Education & Qualifications:

- BTEC (Distinction) Art Foundation in Ceramics 1997-1998 Newcastle College
- BA (Hons) Glass & Ceramics 1998-2001 University of Sunderland
- M.Des Glass Product Design 2001-2002 Edinburgh College of Art
- PhD Glass & Ceramics 2004-2009 University of Sunderland

Design Experience:

- In House Glass Designer for Juo Ltd, Sunderland, 07/06 – ongoing
- In house Senior Glass Designer (Part time) at Edinburgh Crystal, Midlothian, 09/04 – 07/06
- Freelance Designer for Place, Kevin McCloud furniture & Homeware Design, 01/05-05/06
- In house Glass Designer (Full time) at Edinburgh Crystal, Midlothian, 01/02 - 09/04

Professional Positions:

- Director of Juo Ltd 06/02
- Proprietor of Jessamy Kelly Glass 10/07- ongoing
- Board Member of Cohesion Glass Network 06/06- ongoing
- Board Member & Vice Chair of Scottish Glass Society 01/07- ongoing
- Board Member of Design & Made 02/07- 02/08

Teaching Experience:

- Portfolio sessions at University of Sunderland, 06/02- ongoing
- Engraving and Printmaking workshops at University of Sunderland, 04/02
- Product Design workshops at University of Sunderland, 02/05-04/05
- Foundation Level Introduction to Glass & Ceramics at University of Sunderland, 03/06
- Engraving and Printmaking workshops at Edinburgh College of Art, 11/09-12/09
- Kiln casting workshops at Edinburgh College of Art, 10/09–11/09

Other Work Experience:

- Hot Glass assistant at Phoenix Hot Glass Studio, Sunderland, 09/00 to 12/99
- Gallery assistant at the National Glass Centre, Sunderland, 06/00 to 09/00
- Co-organiser & Chair, Parallels and Connections: A Ceramics and Glass Research Student Conference, University of Sunderland. 03/07
- Co-Curator, Delight in Design, Designed and Made Annual Showcase, 06/07-11/07
- Workshop facilitator, Delight in Design, Designed and Made, 06/07-10/07
- Mentor, Prospect Scheme, Designed and Made, 02/08–08/08
- Exhibition Co-Curator, Scottish Glass Society, 2007-2008; 29th Annual Exhibition
- Exhibition Co-Curator, Scottish Glass Society, 2008-2009; Migrate: 30 Years of Scottish Glass
- Co-organiser, Parallels and Connections: A Ceramics and Glass Research Student Conference, University of Sunderland. 03/09
- Artist in residence, Edinburgh College of Art, 10/09-10/10

Workshops:
- 2nd & 3rd International Symposium of Engraved Glass, Kamenicky Senov, Czech Republic 09/99 & 09/02
- Enterprisers 2004, The Cambridge MIT Institute & CFEL Durham Business School 01/04
- Piet Stockmans Masterclass, European Ceramic Work Centre, Netherlands 01/06
- International Glass Symposium 2006, Crystalex, Novy Bor, Czech Republic 10/06
- NESTA, 'Insight Out' Creative Business Course, Digital City, University of Teesside 01/07-04/07

Awards:
- Orrefors 'Student Glass Design Award', Orrefors Glass Factory, Sweden 2000
- Outline Design 'Student Glass Prize' 2001
- Edinburgh Crystal 'Master of Design Scholarship' 2001-2002
- Princes Trust 'Start up Business Award' for Juo Ltd 2006
- Blueprint 'Business Planning Award' for Juo Ltd 'Creative Industries Award' & 'Overall Winner' 2006
- NESTA, 'Insight Out Business Award' for Juo Ltd 2007
- Arts Council England 'Cultural Business Award' for Juo Ltd 2007
- Futures Fund, University of Sunderland for Jessamy Kelly Glass 2008
- Product Development Grant, Cohesion Network for Jessamy Kelly Glass 2008
- The *craft&design* Selected Gold Award: Glass Award 2009
- The *craft&design* Selected Gold Award: Maker of the Year 2009

Membership:
- Axis Artists Database
- Crafts Council National Register of Makers
- Crafts Scotland Index of Selected makers
- Craft & Design Selected
- Contemporary Glass Society
- Cohesion Glass Network
- Designed & Made
- Glass Art Society
- Scottish Glass Society
- World Crafts Council Europe

Formal lectures:
- '2nd International Symposium of Engraved Glass', Kamenicky Senov, Czech Republic, 09/99
- Guest speaker, Cohesion Glass Network, Arts Council England, Newcastle, 11/04
- Glass & Ceramics Research Students Forum, University of Sunderland, Sunderland, 04/05
- PhD Research Students Forum, Gray's School of Art, Aberdeen, 08/05
- Guest speaker, Society of Glass Technology & friends of World of Glass, St Helen's, 11/05
- 'Atoms to Art', Research Cluster Conference, University of Sunderland, 02/06
- 'Glass-Art-Science' Society of Glass Technology Conference, National Glass Centre, 09/06
- 'International Glass Symposium 2006', Novy Bor, Czech Republic, 10/06
- Guest speaker, Cambridge-MIT institute Enterprisers 2007, Durham University, 01/07
- Research Student Conference 'Parallels & Connections', University of Sunderland, 03/07
- 'Atoms to Art', Research Cluster Conference, University College London, 06/07
- Guest speaker, 'Cashing in on Creativity', Business Innovation Centre, Sunderland, 09/07
- Guest speaker, Scottish Glass Society AGM, Edinburgh City Art Centre, 11/07
- Guest Speaker, Friends Society, National Glass Centre, Sunderland, 03/09
- Research Student Conference 'Parallels & Connections', University of Sunderland, 03/09

Exhibition Experience:

2009

- ‘Cohesion at Pyramid’, Pyramid Gallery, York 03/09-04/09
- ‘Glance & Reflect’, Crafts Council @ the Washington Arts Centre, Washington, UK 03/09-04/09
- ‘Melody’ Shoreditch Gallery, London 03/09-05/09
- ‘Cool Glass / Hot Brits’ Zest Gallery at Sofa New York, US 03/09
- Café Jello at Affordable Art Fair, Battersea 03/09
- ‘Artomatic’, Washington DC, US 05/09-07/09
- ‘Blast!09’, Zest Gallery, London 04/09-05/09
- ‘Migrate’, Scottish Glass Society, Highland Galleries & Broadfield House Glass Museum, 07/09-03/10
- ‘UK/OK’, Price Tower Arts Center, Oklahoma, US 08/09-01/09
- ‘Cohesion at Artworks’, Artworks Gallery, Newcastle 09/09-10/09
- ‘Craft and Design Award Solo Showcase, National Glass Centre, Sunderland 09/09-10/09
- Solo Showcase, National Glass Centre, Sunderland 09/09-10/09
- Newcastle Gateshead Arts Fair, The Sage, Gateshead 10/09
- Edinburgh Art Fair, Edinburgh 11/09

2008

- ‘Glass 3’, International Glass Exhibition, Washington DC, US, 02/08-03/08
- Cohesion and Café Jello at Affordable Art Fair Battersea, London, 03/08
- ‘British Glassmakers’, Obsidian Art, Stoke Mandeville, 03/08–04/08
- ‘The Bag Show’, Designed & Made Gallery, Live Theatre Newcastle 04/08-05/08
- ‘Northern Glass’, Platform Gallery, Clitheroe, Lancashire 05/08–07/08
- ‘Blast! 2008’, Cohesion 6th Annual Exhibition, London Glass Blowing Gallery, London 05/08–06/08
- Scottish Glass Society 29th Exhibition, Peter Potter Gallery, Haddington, Edinburgh 07/08–08/08
- ‘Prospect’, Designed & Made Gallery, Newcastle 08/08-09/08
- Solo Showcase, Arts Council Head Offices, Newcastle 08/08-09/08
- Newcastle Gateshead Arts Fair, The Sage, Gateshead, 09/08
- ‘Perfume & Scent bottles’, St Jospeh Galerie, Leeuwarden, The Netherlands, 09/08-02/08
- ‘Beautifully Crafted’, National Glass Centre, Sunderland, 10/08-02/09
- ‘Flawed Inspiration’ DLI Museum, Durham, 11/08-01/09
- ‘Objects of Desire’, Chapel Gallery, Orsmkirk, Lancashire 11/08–01/09
- ‘Cohesion at Artworks’, The Artworks Galleries, Newcastle, 11/09-03/09

2007

- ‘Parallels & Connections’ Showcase, National Glass Centre, Sunderland 03/07
- Cohesion at Affordable Art Fair, Battersea, London, 03/07
- ‘Design Crafts for Contemporary Living’, Bilston Craft Gallery, Wolverhampton, 03/07-04/07
- Newcastle Gateshead Arts Fair, Newcastle, 05/07
- Crafts Council Solo Showcase, National Glass Centre, Sunderland 06/07-07/07
- Summer Fair, Excel London, 06/07
- Scottish Glass Society 28th Exhibition, Lillie Gallery, Milngavie, Glasgow 08/07-09/07
- ‘Cohesion at Pyramid’, Cohesion 5th Annual Exhibition Pyramid gallery, York 09/07-10/07
- ‘Delight in Design’, Designed & Made Annual Showcase, Live Theatre Newcastle 10/07-11/07
- Crafts Council ‘Solo Showcase’ Juo Ltd, National Glass Centre, Sunderland 11/07-02/07
- Christmas Showcase, Tallantyre Gallery, Morpeth, Northumberland, 11/07-01/07
- ‘Twelve’, Designed & Made Christmas Showcase, Live Theatre Newcastle 12/07-01/08

2006

- Glass installation Saltburn Artists Projects, Saltburn, 02/06-03/06
- Affordable Art Fair, Battersea, London, 03/06
- The Temple Gallery, Aberfeldy, Perthshire, 03/06-05/06
- Oriel Ty Gorsaf Glass Gallery, Ynys Mon, Wales, 03/06-07/06
- ‘Cohesion at Artifex’, Cohesion 4th Annual Exhibition Artifex Gallery, Birmingham, 06/06-07/06
- 'Launch 2006', NE Design Showcase, Fire Station, Newcastle Upon Tyne, 06/06
- Scottish Glass Society 27th Exhibition, Collins Gallery, Glasgow, 06/06-08/06
- Crafts Council ‘Solo Showcase’ Jessamy Kelly, National Glass Centre, Sunderland, 07/06-09/06
- ‘The Sea’, Scottish Potters Association, Carby Art Gallery, Aberdeen. 09/06-11/06
- International Glass Symposium 2006, Novy Bor, Czech Republic. 10/06

- ‘Evolve’, Designed & Made, Blackfriars, Newcastle. 10/06
- ‘Gifted’, Royal Museum, Edinburgh. 11/06-01/07
- ‘Winter Warmth’, The Park Gallery, Falkirk Museums, Falkirk. 11/06-01/07
- ‘New Glass’, The Arts & Crafts House, Cumbria. 11/06-01/07

2005
- ‘Glimmer’, Cohesion 3rd Annual Exhibition North Street Gallery, Leeds, 05/05 - 06/05
- ‘Glass in the Garden’ Waterperry Gardens, Oxford, 07/05 - 08/05
- ‘Fusion’ Scottish Glass Society 26th Exhibition Strathearn Gallery, Crieff, 07/05
- ‘Shaping Light 2’, Workplace Art, London, 09/05 - 10/05
- ‘On the Road’, Designed & Made, Mushroom Works, Newcastle Upon Tyne, 10/05
- ‘Winter Glass’, National Glass Centre, Sunderland, 11/05 - 02/06
- ‘Winter Collection’, FiFieFoFum Gallery, Corbridge, 11/05 - 02/06
- ‘Cohesion at Artifex’ Artifex Gallery, West Midlands, 11/05 - 02/06

2004
- ‘Ambiente’, Edinburgh Crystal, Frankfurt Messe, Germany, 02/04
- ‘One Year On’ New Designers 2004, Business Designer Centre, Islington, 07/04
- ‘Glass Al Fresco’, Cohesion Glass Network, 07/04 - 09/04
- ‘The Northern Perspective in Glass’, Scottish Glass Society 25th Exhibition, Bounre Fine Art, Edinburgh, 10/04
- ‘White Christmas’, Bilston Craft Gallery, Wolverhampton, 11/04-01/05
- ‘Lustre’, Tullie House, Carlisle, 11/04 - 12/04
- ‘Blast! 2004’, Cohesion 2nd Annual Exhibition, The Cork Street Gallery, London, 11/04 - 12/04

2003
- ‘Sensation’, Solo Showcase. Heritage Centre, Edinburgh Crystal, 04/03
- ‘The Crystal world’, Edinburgh College of Art, Edinburgh, 05/03
- ‘Convergences/divergences’, Salle Attane, St Yrieix, France, 07/03
- ‘Cohesion 1st Annual Exhibition’, Mezzanine gallery, National Glass Centre, Sunderland, 07/03
- Scottish Glass Society 24th Annual Exhibition, Q2 Gallery, Dundee, 08/03
- Cohesion Christmas Exhibition, Gateshead Quays, 10/03
- ‘Winter Collection’, Cowdy Gallery, Newent, 11/03
- ‘Christmas Collection’ Scissors-Paper-Stone, Castle Eden, Durham, 11/03

2002
- ‘New Directions’, Shipley Art Gallery, Gateshead, 06/02
- ‘Diversity’, Cohesion Glass Cluster exhibition. National Glass Centre, Sunderland, 06/02
- ‘Bastille Day 2002’ North East Glass Artists, French Business Council, Newcastle, 07/02
- ‘3rd International Symposium of Engraved Glass’, Kamenicky Senov, Czech Republic, 09/02
- ‘Master of Design Degree Show 2002’, Sculpture Court, Edinburgh College of Art, 12/02

2001
- ‘Pure’, a showcase of students work at the Globe Gallery, North Shields, 05/01
- ‘Bachelor of Arts Degree Show 2001’, Vardy Gallery, University of Sunderland, 06/01
- ‘New Designers 2001’, Business Design Centre, Islington, London, 07/01
- ‘Pure as Porcelain’, Laburnum Ceramics Gallery, Penrith, 11/01
- ‘By Design’, Chelsea Gallery, London, 11/01

Appendix 11: Case study questionnaire templates

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	
2.Area/Discipline(s)	
3.Materials used in work	
4.Training (please add date/year)	
5.Why do you combine glass & ceramics in your work?	
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	

8.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	
Any additional comments	

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email Jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	
2. What production methods do you use?	
3. What type of kiln(s) and what firing schedule do you use?	
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	
6. What is the inspiration or intent of for your work?	

7. Where can examples of your work be found?	
8. Has you work been published, if so where?	
9. Do you know of other artists working in this way?	
Any additional comments (If possible please attach your CV and artist's statement).	

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

University of Sunderland

Questionnaire 3 Case Study

A ceramic aesthetic in blown glass

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	
2.Area/Discipline(s)	
3.Materials used in work	
4.Training (please add date/year)	
5. Have you ever combined glass & ceramics in your work?	
6. If so, when did you start to combine glass and ceramics in your work? (Please add date/year/image)	
7. What similarities or links have you experienced in the working of glass & ceramics in your work?	
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	
9. Do you work mainly in glass but employ an aesthetic that could be seen as having a ceramic look or style?	

10. In regards to question 9, do you feel this has links to your training or your general approach to materials?	
11. Do you know of other artists working in this way?	

Any additional comments	

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Appendix 12: Completed Case study questionnaire

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Nathan Anderson
2.Area/Discipline(s)	Ceramics – Wheel and sculpture Bronze – Sculpture Wood – Carpentry and furniture Glass – As a ceramic decoration
3.Materials used in work	Clay, Glass, Bronze, Wood.
4.Training (please add date/year)	Ceramics related; Studied under Kristi Downing kkd pottery 1999 to current. Workshops: Wally Asselberghs / 4-2004 & 4-2009 Linda & Charlie Riggs / 4-2008 & 4-2009. Steven Branfman / 5-2005. Kate & Will Jacobson/ 4-2009
5.Why do you combine glass & ceramics in your work?	I like the challenge of the process as well as the final visual effect
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	The first version (recycled glass added to glaze & melted in raku firing) was fall of 2002 The current version (hot glass on a hot pot) began in 5-2005 at the workshop with Steve Branfman
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	Kiln temperatures
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Yes Yes
Any additional comments	My technique uses hot glass on hot Raku fired ceramics. I call it Glasku. I have been collaborating with Michael Boyd of Foci Glass, Minneapolis Minnesota. I have several specialized tools in the prototype stage and a third version of glass application in the beginning experiments. The results are promising and spectacular.

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Nathan Anderson
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	I use Continental Clay Raku clay body. Glass is whatever the standard glass the glass studio uses. Custom glass is among the next steps.
2. What production methods do you use?	Wheel thrown ceramics bisque fired. The wares are glazed and raku fired. The hot raku pots are worked with hot glass. I use a slow, hot, post fire reduction.
3. What type of kiln(s) and what firing schedule do you use?	Electric bisque to cone 07. Gas Raku fire to glassy glaze surface.
10. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	Not yet.
11. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Sculptural
12. What is the inspiration or intent of for your work?	I am fascinated by the effects I get from this combination of Hot Glass and Raku.
13. Where can examples of your work be found?	Private collections only. This work is in development to become consistent and viable to the public.
14. Has you work been published, if so where?	Not published to this date
15. Do you know of other artists working in this way?	Not this method
Any additional comments (If possible please attach your CV and artist's statement).	

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	David Binns
2.Area/Discipline(s)	Ceramics / Glass / Concrete
3.Materials used in work	A wide range of ceramic materials, found minerals (in aggregate / granular form), glass and more recently recycled waste glass
4.Training (please add date/year)	Foundation Course in Art & Design 1977-78 BA (Hons) 3D Design (Wood, Metal, Ceramics) 1978-82 Post Grad Cert in Education 1986
5.Why do you combine glass & ceramics in your work?	Prior to using glass, my work was entirely made from ceramic based materials. I took a base clay, usually porcelain and altered its visual and textural appearance through the addition of pre-fired ceramic aggregates (grogs). Following firing, the pieces were ground and polished to reveal the aggregate/clay matrix and refine the form. I gradually started experimenting in adding a wider range of materials, in order to broaden the aesthetic range of surface qualities. I started adding small amounts of crushed glass as part of this process of experimentation, finding the glass created a new, more dynamic surface – giving greater depth than the purely opaque clay surface. Gradually I added more and more glass, until it became the dominant material. A consequence of this was that pieces required to be fired in moulds to contain the material that became molten in the firing process. Now the majority of my work is glass based, with varying additions of mineral aggregate (made and found). The majority of glass I use is now recycled waste, combined with other types of waste mineral material – creating work that is almost entirely made from recycled waste material. I have also started developing work that involves fusing together purely clay

	components with glass/ceramic components – giving a sharp delineation between the two contrasting materials within a single piece.
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	I first started introducing glass into my ceramic work around 2004, although I first did some experimental tests whilst on a residency at the International Ceramics Studio in Kecskemet, Hungary in 2000
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	It is not really a matter of comparing the two materials, as they have both become part of the same work. There are of course many links between the two materials in terms of chemical make-up – both having varying proportions of silica within them. The process of grinding and polishing has long been part of the glass maker's repertoire. I have 'borrowed' this process and applied it to my ceramic work – a process until recently rarely used by ceramic makers.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Clay artists have tried combining glass with clay for many years, but the incompatibility of shrinkage (coefficient of expansion) has meant that glass when melted onto ceramic has caused it to craze badly – a quality capitalized on by some artists. My approach has been to combine them in granular form. This has created I think a unique aesthetic – you don't get a completely opaque clay surface and you can't achieve a fully translucent material – the aesthetic qualities are unique – a surface that has a greater visual depth – depending on the ratio of glass with ceramic material. What I like is the fact that what is seen on the surface, passes through the core of the entire piece. The material itself gives provides the aesthetic of the piece without the need for any additional secondary surface embellishment, as is common in ceramics – decorative motif's, glaze etc..
Any additional comments	Check out my website – although at the moment some pages are off-line. www.davidbinnsceramics.com

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com

Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Steven Branfman
2.Area/Discipline(s)	Raku vessels
3.Materials used in work	Ceramic raw materials (glaze), stoneware clay, colored glass.
4.Training (please add date/year)	M.A.T., Rhode Island School Of Design, 1975 B.A. Cortland State University
5.Why do you combine glass & ceramics in your work?	The similarities between glass and ceramic glazes have always interested me. Naturally, devising a way to combine them in my work was of interest.
6. When did you start to combine glass and ceramics in your work? (Please add date/year/image)	I've been working with glass in my work for approximately 15 years. (1994)
7. What similarities or links have you experienced in the working of glass & ceramics in your work?	I use the glass for color and texture. My method involves the inlaying of crushed glass into the surface of wet clay. While there is a recognizable similarity between the melted glass and traditional ceramic glaze, ironically it is the dissimilar nature of the materials that result in the surfaces that I work to achieve.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	My vessels are all about aesthetics; form, shape, volume, presence, and how the surface defines these characteristics. My surfaces are not canvases upon which to decorate. My surfaces are "skins" that define the inner volume and pressure. The glass inlays work to help in this definition and statement. No
Any additional comments	My vessels begin as thrown cylinders. I arrange the crushed glass (different colors and sizes from dust to as large as 1/8" in diameter) on the table in patterns noting color, tone, contrast and size. I roll the wet cylindrical form on the glass. The wet clay picks up the glass. I then paddle the glass to press it into the surface. I repeat this

	process several times until I apply the amount of glass and the patterns that I am looking for. The cylinder is then placed back on the wheel and the vessel is formed from the bottom up and inside out without touching the surface of the form. The action of expanding the form stretches the surface and creates interplay between the inlaid glass and the shapes that form around it.

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Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Steven Branfman
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	The glass is common flat glass used by stained glass workers. The glass is random in type and manufacturer. I choose it for color and texture only. My clay body is Laguna #250 manufactured by Laguna Clay in the USA.
2. What production methods do you use?	My vessels are wheel thrown. The glass is crushed into various size particles and inlaid into the wet clay cylinder. The form is then expanded from the inside out.
3. What type of kiln(s) and what firing schedule do you use?	Work is raku fired. I use both electric and propane fueled kilns.
16. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible.	I use glazes with and over the glass.
17. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	One of a kind decorative vessels.
18. What is the inspiration or intent of for your work?	My forms are inspired by eastern cultures; Japan, Korea, Middle East. My surfaces are inspired by the natural surfaces found in nature.
19. Where can examples of your work be found?	Private and public collections in the USA and Europe. Web site: http://www.americanpotters.com gallery.tpl?ID=309928794111903
20. Has you work been published, if so where?	In many books and magazines. Please see the listings in my resume previously supplied.
21. Do you know of other artists working in this way?	Many potters who have attended my workshops have adopted my methods.
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Edmée Delsol
2.Area/Discipline(s)	*Peinture sculpture* Painting sculpture
3.Materials used in work	Terre et verre Ceramics & Glass
4.Training (please add date/year)	*Ecole nationale supérieure des Beaux Arts de Paris 1963-1967* *Peinture sculpture mosaïque* *Travail en architecture* *Stages raku chez C.Virot 1979 1983*
5.Why do you combine glass & ceramics in your work?	*Le mineral; la composition de la terre, de l'émail et du verre….une terre peut se vitrifier….les 2 passent par le feu….* *Correspondances et contrastes* *Le verre peut être la continuité de la terre…* *Le passage entre les 2 matières m'interresse, entre l'obscur et la clarté….* The mineral composition of the ceramic, enamel and glass, a ceramic can be vitrified, the 2 both pass by fire. The correspondences and contrasts; glass can be the continuity of the ceramic. The way 2 matters engage interests me, between the density and clarity.
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	*En 1980, je travaille la terre* *En 1990, je combine les 2 matières, la terre et le verre* In 1980, I work the ceramic In 1990, I combine the 2 matters, the ground and glass
7.What similarities or links have you experienced in the working of glass & ceramics in your work? 8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	*2 techniques differentes de cuisson, la terre et le verre se transforment à la cuisson, la terre se durçit, le verre se liquifie avant de durcir; la terre se rétracte et pas le verre: problème à résoudre pour certains assemblages….* 2 different techniques of firing, the ceramic and glass change with firing, the ceramics hardens, glass liquefies before hardening; the ceramics retracts and not glass: problem to be solved for certain assemblies….

9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	*Le poids du verre d= 3,6* *Rapport à la terre pour faire un ensemble cohérent* *Opposer les 2 matériaux et les mettre en harmonie pour une " unité"* The weight of glass d= 3,6 Report/ratio with the ceramics to make a coherent unit To oppose 2 materials and to put them in harmony for a" unit"
Any additional comments	

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Edmée Delsol
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	*Verre: crystal optique C2036 de chez Corning* *Terre: grés de chez Céradel + terres naturelles ramassées et mélangées dans 1 pétrin* Glass: optical crytsal C2036 from Corning Ceramic: from Céradel + natural ceramics collected and mixed in 1 kneader
2. What production methods do you use?	*Faconnage à la main , par plaques, par ajouts Pour la terre. Moules en plâtre et sable pour la pâte de verre* Shaping with the hand, by plates, additions. For the ceramics Moulds out of plaster and sand for the molten glass
3. What type of kiln(s) and what firing schedule do you use?	*1 four à bois* *1 four "raku" gaz et bois pour la terre 1000°* *1 four électrique avec programmation pour le verre* 1 furnace with wood 1 furnace "raku" gas and wood for the ceramic 1000° 1 electric furnace with programming for glass
22. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	*Je peux ajouter des chamottes, de la vermiculite dans la terre* I can add grogs, vermiculite in the ceramic
23. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	*Je fais des pieces uniques, objets, sculptures* I make single parts, objects, sculptures
24. What is the inspiration or intent of for your work?	*les passages, la nature , l'architecture, ce qui me touche,* *la vie et la mort, l'ici et l'ailleurs….* *Le vide et le plein, l'ambiguité avec le verre* Passages, nature and architecture which touch me, life and death, here and elsewhere. The void and the space, the ambiguity of the glass.
25. Where can examples of your work be found?	*Musée de la céramique à Sèvres* *Musée de Sars poteries* *Musée de Conches, d'Elbeuf* *Frac deBasse Normandie*

26. Has you work been published, if so where?	*H.D.NICK 2000* *Galerie Complément d'objet 1998* *Galerie Capazza 2007*
27. Do you know of other artists working in this way?	*Je pense avoir été dans les premieres à assembler ces 2 matériaux* *Hanneke Fokkelman* *Gerard Fournier (pierre et verre)* *Vladimir Zbynovsky (pierre et verre)* I think I have been the first to assemble these 2 materials Hanneke Fokkelman Gerald Baker (stoneand glass) Vladimir Zbynovsky (stone and glass)
Any additional comments (If possible please attach your CV and artist's statement).	*Maison des artistes*

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Questionnaire Case Study 1

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Tashima Etsuko Osaka, Japan
2.Area/Discipline(s)	Glass
3.Materials used in work	Ceramics and Glass
4.Training (please add date/year)	I studied ceramic art at Osaka University of Arts for 4 years. Since then I have made and designed the glass works my original work which combines glass and ceramic.
5. Why do you combine glass & ceramics in your work?	Because I find it interesting to combine two different materials in order to express my own sense of beauty.
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	Since 17 years ago.
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	Diversity how to be formed and attractiveness welled up from something in nature.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	The point I want to emphasize is harmonisation between two distinctive materials that has contrastive characters. E.g.) ceramics and glass. I feel an energy from lights coming through transparent glass. On the other hand, ceramics can not pass through light. However, I feel warmth from a texture of ceramics including smells of soil and under glaze with a good glass. I think they can be a symbol of strength, beauty, richness and warmth from nature. Harmonization between art and nature can be derived from Japanese traditional sense of beauty. I think it takes me an effect, move or less. That is what I want to express with my works. No
Any additional comments	

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Tashima Etsuko
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Glass is got from the company called 'Santoku Co.' which provides cullet for people who are relevant to any art. Ceramics is also got from another company called 'Kaneri', in Sigaraki , Siga f prefecture where is famous for ceramics. A type of ceramics I use is just a normal clay.
2. What production methods do you use?	I put ceramics and glass together with some glue. Ceramic parts : slab building Glass parts : Mould casting
3. What type of kiln(s) and what firing schedule do you use?	Electric Kiln. The highest temperature at 880□ and it should be kept for about 3 ~ 9hours. And it is cooled down with enough time.
4.Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	None.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Modern ceramic sculpture
6. What is the inspiration or intent of for your work?	Basically, beauty of nature, especially the form of plants and their colour variations, and hopefully would like to express the richness and happiness that is able to get from all harvests in nature. I see plants as strength of nature and how feminine they are like. For this reason, I put the title called 'Cornucopia' on my exhibits, which means goddess (Venus?) or feminine in Greek. In addition, by 'Cornucopia' I simply mean the spirit of fertility. My sense of aesthetic may be seen on my works on how they complete in symmetrical, triangular, square, pentagonal and hexagonal balances. In order to express more richness, I try to paint yellow on white ceramics parts which is white. That is because I attempt to put more brightness which is able to represent being rich. It is often said that bright colour like red, yellow, etc. stands for rich food or warmth. That can be why I make my works like that.

7. Where can examples of your work be found?	Exhibition: ・ Art Gallery X, Takashimaya , Nihonbashi, Tokyo September 30 ~ October19,2009 ・ Tsukuba museum of Art, IBARAKI pref. October 9 ~ November 8,2009
8. Has you work been published, if so where?	Exhibition Catalog : 'The legacy of Modern Ceramic Art' / Museum of modern Ceramic Art, Gife pref. / 2002 'Contemporary Master Ceramists of Western Japan' / Ibaraki Ceramic Museum, Ibaraki pref. / 2003 'Yurinso Tashima Etsuko Ohara Museum of Art' / Ohara Museum of Art, Okayama pref. / 2004 'Cool & Light New Spirit in Craft Making' / The National Museum of Modern Art Tokyo, Craft Gallery / 2004, McCreery, Ruth S. (Ruth South), 1946- 'The Quintessence of Modern Japanese Ceramics' / Ibaraki Ceramic Art Museum, Ibaraki pref. / 2006 'Tashima Etsuko's Works 1995-2006' / Yamaki Art Gallery, Osaka pref. / 2006 'Soaring Voices-Contemporary Japanese Women Ceramic Artists' / The Shigaraki Ceramic Cultural Park, Siga pref. / 2007 'Masterpieces Ceramics' / The Natinal Museum of Modern Art Tokyo, Craft Gallery / 2007 Publication 'Kerameiki Techni' Issue44, Greece/ August 2003
9. Do you know of other artists working in this way?	None.
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Jean Fontaine
2.Area/Discipline(s)	Sculpture
3.Materials used in work	Clay (stoneware and porcelain) +glass+iron+wood+paper
4.Training (please add date/year)	Dïplome national des Beaux Arts (Macon 1975)+Licence Arts Plastiques à la Sorbonne (Paris 1974)
5. Why do you combine glass & ceramics in your work?	*Mon travail est pour beaucoup fondé sur les contrastes : noir et blanc, parties humaines (et-ou animales) et parties mécaniques, le verre me permet d'opposer des formes en verre simples, pures, ,fragiles à des formes complexes, supposées solides.* *De plus verre et céramique sont deux matériaux qui « s'entendent » bien, ce sont tous deux des matériaux transformés par le feu , ils ont donc une même histoire…* *L'ajout de verre dans mon travail, même s'il est fréquent, reste anecdotique..* My work is mainly founded on contrasts: black and white, parts human (and/or animal) and mechanical. Glass enables me to oppose the shapes out of glass simple, pure, fragile with complex forms, presumably solid. Moreover glass and ceramics are two materials which "get along" well, they are both of materials transformed by fire, and they thus have the same history… The addition of glass in my work, even if it is frequent, remains anecdotic.
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	*Dans la décennie 1990…la sculpture autorise , permet l'usage de tout les matériaux, pourquoi se limiter à un seul, chaque matériau a une personnalité impliquant fragilité ou force, transparence, matité ou brillance, naturel ou artifice, plasticité ou rigidité…la terre est mon matériau de prédilection car elle est sans personnalité affirmée, elle prend toutes les formes et les aspects que l'on désire, il n'est pas nécessaire de jutter pour la travailler , on se confronte au bois au fer à*

	la pièrre, la terre on la caresse…Le verre est très difficile à travailler techniquement et permet donc peu de liberté pour moi…l'excés de technicité nécessaire limite d'autant la spontanéité. *J'ai utilisé pour la première fois le verre pour une sculpture représentant un rhinocéros, j'ai utilisé pour la corne du verre soufflé pour montrer que cette corne censée le défendre était en fait la cause de sa disparition….l'ambiguité entre la fonction de cette corne et la matière verre était juste…(je trouve.. !)* In the decade 1990… the sculpture authorizes, allowed the use of all materials, why to limit itself to only one, each material has a personality implying brittleness or force, transparency, matt or brightness, naturalness or artifice, plasticity or rigidity… the ground are my material of predilection because it is without affirmed personality, it takes all the forms and the aspects which one wishes, it is not necessary of jutter to work it, one is confronted with wood with iron with the stone, the ground one cherishes it… glass is very difficult to work technically and thus allows little freedom for me… the excess of technicality necessary limits of as much spontaneity. I used for the first time glass for a sculpture representing a rhinoceros, I used a horn of blown glass to show that this supposed horn to defend was in fact the cause of its disappearance…. ambiguity between the function of this horn and the matter glass was right… (I find!)
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	Voir ci-dessus SEE ABOVE
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Voir ci-dessus SEE ABOVE No
Any additional comments	

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Jean Fontaine
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	*J'utilise principalement du grés de Saint Amand (à coté de Nevers au centre de la France, chamotté fin pour garder une véracité du détail et avoir une résistance forte au séchage et à la cuisson, je joins aux formes en grés des ajouts de porcelaine coulée, tournée, de vieux isolateurs ou marériels électriques .* *Les parties en verre sont soufflées dans différents ateliers (Morin à Dieulefit principalement) les magnifiques cornes sur certaines sculptures ont été faites en Ukraine à Lvov.* I use mainly Saint Amand (from Nevers in the centre of France, grog end to keep a veracity of the detail and to have a strong resistance to drying and firing, I unite the forms with porcelain slip additions, and old electric insulators. The parts out of glass are blown in various workshops (Morin with Dieulefit mainly) the splendid horns on certain sculptures were made in Ukraine with Lvov.
2. What production methods do you use?	*Moulage, coulage, extrusion, modelage bien sur, explosion…tout est bon! Chaque technique (il y en a beaucoup en céramique) apporte un élément important : véracité, liaison, force, résistance…la technique n'est pas figée, elle évolue, elle s'invente pour de nouveaux usages, de nouveaux rendus…* Moulding, casting, extrusion, modelling of course, explosion… all are good! Each technique (there is much out of ceramics) brings an important component: veracity, connection, force, resistance… the technique is not solidified, it evolves/moves, it invents for new returned uses, the new ones…
3. What type of kiln(s) and what firing schedule do you use?	*Four à gaz de ville (butane), cuisson en athmosphère neutre à réductrice, longue (14-16 heures),baisse en température trés lente pour ne pas « secouer » les sculptures..* Furnace gas for domestic use (butane), cooking in neutral atmosphere with reducing, long (14-16 hours), drops in very slow temperature careful not "to shake" the sculptures.
4.Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them	*Tout les matériaux peuvent s'employer! Je ne suis pas un céramiste borné qui n'utilise que des matériaux céramiques avec des techniques céramiques, les ajouts collés après cuisson sont*

more compatible?	*dépendants de l'effet recherché : contrastes de couleurs, contrastes de toucher, contraste sde brillance…je n'ajoute rien à la terre proprement dite…* All the materials can get busy! I am not a limited ceramist who uses only ceramic materials with ceramic techniques, the additions stuck after firing are dependent on the required effect: contrasts of colors, contrasts of touching, contrast and brightness… I do not add anything to the ground itself…
5What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	*Sculptural, unique (sauf pour les tirages en bronze)* Sculptural, unique (except for bronze casts – limited edition)
6What is the inspiration or intent of for your work?	*Mon intention est de rapprocher l'homme et ses machines , de montrer toute cette mécanique qui nous bouffe…les machines sont nos enfants dont nous ne pouvons plus nous passer…démystifier nos corps dont nous peaufinons l'apparence mais dont l'intérieur n'est également que mécanique, mécanique qui se répare,se change, se remplace par de vraies machines…je navigue entre fascination et rejet de cette technicité souvent incontrolée…* My intention is to bring closer man and machines, the machines are our children of which we cannot pass to us any more… to demystify our bodies of which we polish the appearance but of which the interior is also only mechanical, mechanics which is repaired, changed, is replaced by true machines… I sail between fascination and rejection of this often uncontrolled technicality…
7Where can examples of your work be found?	*Sur mon site: jeanfontaine.com!* *+beaucoup de catalogues d'expo (une dizaine), Zoofolie et Mécanofolie ont un exemplaire en anglais et peuvent être trouvés à la Galerie Humus à Lausanne en Suisse (place des terreaux), peut être sur le net…* On my site: jeanfontaine.com! + lots of catalogues of expo (ten), Zoofolie and Mécanofolie have an English specimen and can be found with the Gallery Humus in Lausanne in Switzerland (place of the composts), can be on the Net…
8Has you work been published, if so where?	
9Do you know of other artists working in this way?	*Giger, Bosch, pour l'esprit du travail …(avec l'humour en moins)* Giger, Bosch, for the spirit of work… (with humour in less)
Any additional comments (If possible please attach your CV and artist's statement	*Je vous envoie qq photos de dernières sculptures + CV* I send qq to you photographs of last sculptures + CV

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Questionnaire Case Study 1

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Kristin Gudjonsdottir
2.Area/Discipline(s)	Mixed media sculpture
3.Materials used in work	clay cast glass, ceramic, metal and stone
4Training (please add date/year)	1989-1991 Sculpture. Icelandic collage of Arts and Crafts.(now called Iceland academy of the arts) 1991-1995 BFA in Sculpture and glass from California Collage of Arts and Crafts (now called California College of the Arts)
5.Why do you combine glass & ceramics in your work?	Because these materials look good together and can easily be manipulated to work together.
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	My first clay cast glass piece was made in 1993. Right there after I started including clay as part of the surface treatment of the glass. The natural next step was to have part of the work make of clay.
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	Both can take high heat without blowing up. I can in the same kiln at the same time cast glass as I am firing a ceramic piece. I can slump a glass piece easily on a clay piece in the kiln without anything breaking. Using kiln wash in between just to be safe. Similar in the respect that glass likes to stick to clay as in glazes so why not have clay on the surface of glass. Some clay types seem to have a similar contraction when cooling as clay so great to cast together or to create molds that have a hole in them like making a glass circle using clay as the mold material.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	I can't think of any. I think I have solved all that I had No
Any additional comments	Can't think of any but don't hesitate to ask me if the above info is not clear or if I have misunderstood the question.

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Kristin Gudjonsdottir
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Stoneware ceramics and cast glass
2. What production methods do you use?	Hand building and casting
3. What type of kiln(s) and what firing schedule do you use?	electric
28. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	Yes, metal and stone
29. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Sculptural
30. What is the inspiration or intent of for your work?	Reused and found materials
31. Where can examples of your work be found?	Collections, galleries
32. Has you work been published, if so where?	no
33. Do you know of other artists working in this way?	no
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Amy Lemaire
2.Area/Discipline(s)	Lampworking/ceramic sculpture and jewelry
3.Materials used in work	Soda-fired stoneware with lampworked glass accents, lampworked glass, sterling silver.
4.Training (please add date/year)	Pratt Institute, NY – MFA 2010 Pilchuck Glass School – studied with Vittorio Costantini 2006 School of the Art Institute of Chicago – BFA 2000 Glasgow School of Art – exchange program 1999
5.Why do you combine glass & ceramics in your work?	In 2004, I moved my studio to Lillstreet Art Center in Chicago, where I had started a small lampworking program a couple of years earlier. Lillstreet is predominately a ceramics facility, and eventually I started thinking about the possibility of incorporating clay into my work. It was the bead seperator, a thin clay slip applied to the mandrel, that peaked my interest, as the variety I use is not graphite based, but closer to a clay slip, and thinned with a deflocculant. I was also making a lot of small jars, lampworked around a clay core. I decided to experiment to see if it would be possible to lampwork directly onto a clay bead. There are surface effects which occur during the soda-firing process which I wanted to incorporate into my work. Also, It seemed possible to have portions of the work fired in reduction, and others fired in oxidation together in the same piece for a wider palette range.
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	The first experiments began in 2004 with low fire earthenware. (failed) Then, after extensively reading about the makeup of glass, clay, and glaze, the soda-firing process seemed like a better fit, and I started using a high-alumina clay body (made in batches for Lillstreet from Continental Clay)
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	While researching glaze chemistry and glass chemistry, I was struck by the similarities in chemical makeup, and that some information (specifically, how to

	adjust the COE of a glass or glaze, tinting colors of glass/glaze) crossed over from glass to clay or vice versa.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Glass, when used in combination with clay often takes on “wet” qualities, while the clay seems “dry”. It seems that the liquidity, or fluidity of glass is emphasized. Of course, this is based only on what few pieces I have seen which combine glass/clay. Yes
Any additional comments	Using my process, it is possible to exploit the fusion of oxidation and reduction firing. Since the clay is fired to maturity first, and then fired to a lower temp to add the glass, it is possible to fire clay in reduction, and glass in oxidation, or vice versa. This is especially important when using borosilicate glass, as the colors are very finicky. I have not seen any technique using glaze, slip trailing or otherwise where the dots are articulated in quite this way, where they wit on the surface quite like a water droplet.

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Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Amy Lemaire
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Clay – "Lillstreet Special" from Continental Clay; a high-alumina clay body made in small batches for Lillstreet Art Center in Chicago and fired in their soda kiln. I've also used other Continental products, white stoneware, iron red stoneware, and porcelain. Glass – For a while I used Effetre (coe 104), Lauscha, Vetrofond, Creation is Messy, and Ornella and Reichenbach-104 (reduction glass)– all coe 104. I buy my glass mostly from Frantz Art Glass, and sometimes from Arrow springs and more recently from Jodel Glass. I have since switched to using boro, as there is less crazing. Northstar and Glass Alchemy form Frantz Art Glass.
2. What production methods do you use?	The clay is bisque fired, and then glazed. I apply several layers of colored underglaze, and then either a clear or colored glaze over that. The pieces are then fired to maturity, usually soda or salt fired, but some are just fired to cone 10 in an electric kiln in order to achieve certain colors. Then, the ceramic pieces are fired a third time to cone 014 in an electric kiln, and pulled out at the peak of the firing, At this point, the glass is added in the flame (Nortel Midrange burner) using lampworking techniques, soaked for a couple of hours at annealing temperature and cooled slowly overnight.
3. What type of kiln(s) and what firing schedule do you use?	I use electric or gas kilns of varying sizes to bisque. It depends on which studio I am working in and what is available. For the cone 10 firing, I have used the soda kiln at Lillstreet Art Center in Chicago, Lillstreet's Bailey car kilns to cone 10. Last summer I worked out of Watershed Center for the Ceramic Arts in Maine, and used their salt kiln. I also do small cone 10 batch firings in my Olympic kiln. For the third firing, I now use the cone 014 bisque setting on my Olympic, and that works pretty well. On other kilns, I will ramp up manually over 3-4 hours. This program does not need to be precise, just heat the clay up slowly, and when it starts to glow, hold the temperature for a few hours. I hold it at 014 for three hours, which is usually how long it takes me to put the glass on all the pieces. After the glass is added, either in reduction or neutral flame, depending on the effect I am going for, the piece is placed in an annealing kiln, usually the Jen-Ken kiln, and held at 1050 degrees F for boro, or 960 degrees F for Effetre/soft glass. The temperature is ramped down over 6 – 8 hours.

4. Do you use any other materials in your work? (Or add any extra materials to your glass or ceramic bodies to make them more compatible?)	Some of my pieces have extra flameworked components added to them once the fusion firing is complete. For example, the sprouting pod pieces. These sprouts are not fused, but are detachable, to make shipping easier. The finished pieces are often combined with other materials to create sculptures or jewelry. In the past I have used found wood, silver, encaustic, brass, and live plant matter in the finished sculptures.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	All of my pieces are one off's, but I work in batches, due to the lengthy production process. The only exception I've made was in the case of jewellery, where I have made a few of the same bead in order to complete a neckpiece which was a one off. (Woodland pod necklace)
6. What is the inspiration or intent of for your work?	I am inspired by what I find in nature, but seek to make my own improvements on nature's designs. The colors I use come from urban sources: interior design, advertising. By merging these two worlds, I can then create something which takes on a life of it's own.
7. Where can examples of your work be found?	Private collections throughout the US, Lillstreet Art Center in Chicago, Haus in Chicago, and Urban Glass in Brooklyn, New York. Underwater sculptures were featured at the 2009 New York Horticultural Society's Annual Gala, at the Head table. Other ongoing projects with Flora New York, in New York City. More to come after June 2010, as I am currently developing a new jewellery production line and working on a larger sculpture.
8. Has you work been published, if so where?	See resume for list
9. Do you know of other artists working in this way?	After the Ceramics Monthly article came out, I received a lot of emails from people who were conducting their own experiments with glass and clay. Most were students, and there did not seem to be much success. I have taught a couple of workshops on this technique, but to the best of my knowledge, the students in the class have not incorporated the technique into their work aside from what they made in the workshop. (Most said it was too labor intensive for their tastes)
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Jenny Mulcahy
2. Area/Discipline(s)	Visual art
3. Materials used in work	Ceramic & Cast Glass (Arch series)
4.Training (please add date/year)	2001- 2009 PhD in Creative Arts, James Cook University, Townsville, Queensland 2004 Graduate Certificate of Tertiary Teaching, James Cook University, Queensland 1994 – 95 Graduate Diploma of Visual Art Monash University Victoria 1983 – 84 Diploma Fine Art T.A.F.E. Townsville Queensland 1981 – 82 Diploma Visual Arts W.I.A.E., Warrnambool, Victoria
5. Why do you combine glass & ceramics in your work?	I find it technically challenging and the contrast between the heavily textured ceramic surfaces and cast glass aesthetically pleasing
6. When did you start to combine glass and ceramics in your work? (Please add date/year)	Jan 2001
7.What similarities or links have you experienced in the working of glass & ceramics in your work? 8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	• Both very process driven • Both require specific firing cycles
9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	The difficulty in determining the cast glass shrinkage rates in relation to the mould in which it is cast ,and the removal of extraneous glass from the final cast. i.e. The mould (for casting the glass), is made from a ceramic section which has been cut from the sculpture when leather hard, allowed to dry and then be fired in its original position thus retaining an almost perfect fit.

	This section is then removed and a mould made so its shape can be replicated in glass. The problem/s difficulties are caused by the slight shrinkage of the glass during the firing/annealing and also by the protrusion from the pouring sprue which is a real pain to cut/grind off if you don't have all the specialised equipment. This can lead to problems with perfectly fitting the cast piece into the aperture left for it.
Any additional comments	The comments on this particular document refer to my work which combines cast glass sections into fired ceramic pieces, not the work I do using *pâte de verre.*

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Jenny Mulcahy
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	A ceramic body I mix myself which incorporates perlite The glass I use for casting is Blackwood Crystal, made in Victoria, Australia Frit for *pâte de verre* is Bullseye Glass from Portland USA
2. What production methods do you use?	Hand built
3. What type of kiln(s) and what firing schedule do you use?	Electric Kilns with a 12 stage programmer Schedules are individually adapted for each piece. Some of my ceramic components take several days to fire due to their thickness
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	I sometimes add metal found objects Perlite
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Sculptural
6. What is the inspiration or intent of for your work?	My work is mainly landscape-based. The glass components act as a metaphor for the earth's innate energy. My last major body of work was for my PhD and was exploring the visual interpretation of silence and focused on the landscape around a defunct uranium mine
7. Where can examples of your work be found?	Journals as listed on CV Web entries/ links to exhibition sites under Jenny Mulcahy My own web site is still under construction
8. Has you work been published, if so where?	See attached CV
9. Do you know of other artists working in this way?	No
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire Case Study 1

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Sally-Anne Osborne (now married and called Bubbers)
2.Area/Discipline(s)	Mainly Ceramic and glass but have an interest in plastic
3.Materials used in work	Any clay but normally bone china, porcelain, glass, various plastics and metal
4.Training (please add date/year)	Staffordshire university. Stoke-on-Trent site Design and craft. Graduated 2006
5.Why do you combine glass & ceramics in your work?	I love the unpredictability of it! I am never completely sure what is going to come out of the kiln. There is something very rewarding (and frustrating) about not being able to have complete control over the materials. But you can get the most amazing results.
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	2004, when someone told me it could not be done.
7.What similarities or links have you experienced in the working of glass & ceramics in your work? 8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	Both fired in kiln, Both use moulds Both seen as natural elements Tactile I like using glass on unglazed clay to accentuate the matt and gloss
9.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Too many to list! I spent nearly a year (at uni) experimenting and gaining my limited understanding of how the two materials fill together and I learn every time I do a firing. The stresses the two forces excerpt on each other are enormous. I still have bowls that will just split in two for no apparent reason 6 months after I have made them.

Any additional comments	I love the challenge of working with the combination of the two materials. I don't think many people understand the complexities, but I have had a lot asking me how I do it. If I had to only choose one material I think I would go for the glass. I will attach some more recent pictures.

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Sally-Anne Bubbers (nee Osborne)
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Bone china, various suppliers Porcelain, various suppliers Frit scavenged from hot glass shop! Various frit from 'warm glass'
2. What production methods do you use?	Casting and Firing myself Someone has thrown pots for me and I have fired them.
3. What type of kiln(s) and what firing schedule do you use?	Ceramics kiln - electric. Schedules took me a long time to work out...sorry cannot disclose. It is very difficult.
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	No
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Each piece is one off. Never know how they are going to turn out.
6 What is the inspiration or intent of for your work?	My glass is Light and texture My work with ceramics is Geodes Rough outsides that are tactile with glittery insides.
7. Where can examples of your work be found?	My work has evolved since I set up my website ozziart.co.uk I also have some on CGS web site
8. Has you work been published, if so where?	no
9. Do you know of other artists working in this way?	no
Any additional comments (If possible please attach your CV and artist's statement).	I have not done much lately because I have just completed an MSc in Counselling and Psychology. Once I am financially stable i will spend 2 days a week on my art. I did not want to end up in my garage churning out stuff to try and make a living. I decided to earn my living from counselling and then be able to produce the type of art I enjoy producing – random unpredictable stuff!

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Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	David Roberts
2.Area/Discipline(s)	Ceramics/ Glass
3.Materials used in work	Largely 3mm float glass and black scarva clay bodies.
4.Training (please add date/year)	2005 2006 Foundation studies Art Design and Media 2006 2008 Foundation degree Applied Arts Ceramics Glass and Metals. 2008 2009 B.A. (Hons) Applied Arts Ceramics Glass and Metals.
5.Why do you combine glass & ceramics in your work?	The multiple layers of 3mm float glass in the sculptures reflect and refract light. The use of a black clay body presents a powerful counterpoint to this interaction absorbing light as opposed to reflecting it. In addition the use of clay as a grounding material for the glass presented an opportunity to express the geometric origin of my work in fundamentally differing ways and yet still achieve a harmonic relationship between them.
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	I first started to combine the materials in the second year of my Foundation Degree (2008)
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	I developed a working practice which allowed me to utilise equipment traditionally associated with one material and exploited those potentials to develop aesthetic qualities within another. As an example the black scarva clay used in the ceramic forms could be linished after an earthenware firing to achieve a very smooth surface allowing a fine speckle to develop. The piece could then be fired to stoneware.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9.What technical difficulties (if any) have	I believe there is a need to keep an open mind, to question and probe the existing understanding of the materials we are working with. The aesthetic qualities that developed in my work were regarding material contrast and the expression of the combined materials within space. None

you experienced in combining glass and ceramics in your work?	
Any additional comments	In order to present a better understanding of the work I have been producing I have attached a linear study, a piece produced in glass only and pieces combining ceramic and glass. To allow for details of the work they are as word documents sent individually..

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	David Roberts
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	3mm float glass and black Scarva clay bodies.
2. What production methods do you use?	Hand building, cutting
3. What type of kiln(s) and what firing schedule do you use?	Electric
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	no
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	sculptural
6. What is the inspiration or intent of for your work?	Light The harmonic relationship between glass and ceramics.
7. Where can examples of your work be found?	Galleries
8. Has you work been published, if so where?	Not yet
9. Do you know of other artists working in this way?	no
Any additional comments (If possible please attach your CV and artist's statement).	

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Questionnaire 1 Case Study

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Glass & Ceramics PhD research student at the University of Sunderland

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1.Practitioner's name	Sally Resnik Rockriver
2.Area/Discipline(s)	Geochemical Sculpture
3.Materials used in work	Blown Glass and Ceramics
4.Training (please add date/year) see resume attached	1996 M.F.A. Ceramics and Combined Medias, Hunter College, N.Y.C. 1992 B.F.A. with Honors, Ceramics and Painting, University of North Carolina at Chapel Hill. Dean's List: 8 semesters.
5. Why do you combine glass & ceramics in your work?	I am making geological formations that occur at the intersection of hot glass and ceramic materials. In order to create the planetary surfaces and chemical reactions I must work with these elements at these temperatures.
6. When did you start to combine glass and ceramics in your work? (Please add date/year)	I started using melted glass on my ceramics in 1993 when I formed crystalline glaze paintings. When I started blowing glass in 1996, the marriage of these mediums was immediate. I started applying ceramic glazes to hot blown glass and casting glass and ceramics. I also sculpted ceramic pieces that I assembled with finished glass pieces.
7.What similarities or links have you experienced in the working of glass & ceramics in your work? 8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	With both, I can freeze a moment in time when a thermal activity has created a geological formation.
9.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	The different coefficients of expansion/contraction has proven challenging. These limitations have dictated much of my process and aesthetic. There is a greater tendency toward cracking, and each new combination requires research.
Any additional comments	

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Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Sally Resnik Rockriver
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Glass: System 96, all/any fritt, sheet glass, cullet, casting billets. (Supplier: Olympic Color Rods) Ceramics: Cone 5-10 clay, 3110 Frit, Oxides, Zinc, Silica, Cryolite, Potash, Epk. (Supplier: Bailey Ceramics) Other: Sand, Salt, Soda, Epoxy
2. What production methods do you use?	Hot glass blowing, Kiln Casting, Ceramic Kiln Firing.
3. What type of kiln(s) and what firing schedule do you use?	Bailey Rolling floor Front loader and Top Loading Olympic Kilns. All rated Cone 10. Items are fired 2-4 times to achieve combinations. Firing temps range from 950 F- 2350F.
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	I use ceramic materials that contain soda flux agents and they are closely compatible to the glass. In my work, the incompatible element adds iridescent fissures that become an important part of the geological content of the art. I use sand, glory hole floors, kiln bricks, and all remaining materials from the production process as part of the content of the final work.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Sculptural one of a kind
6. What is the inspiration or intent of for your work?	Imagining the potential geology of other planets. Underwater sealife, rock creatures, and the scientific nature or limitations of the materials that I am working with.
7. Where can examples of your work be found?	Private collections, occasional exhibits in NY City, locally in Chatham County NC. Publications listed.
8. Has you work been published, if so where?	Publications listed on attached. Individual published works listed on other attached.
9. Do you know of other artists working in this way?	NO
Any additional comments	

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1.Practitioner's name	Alfred P. Spivack, M.D. spivacka@comcast.net
2.Area/Discipline(s)	Medicine (Cardiology) Ceramics Fused Glass
3.Materials used in work	Clay and Glazes Art Glass (Flat sheets) and Frit Dichroic Glass
4.Training (please add date/year)	Medicine: Thomas Jefferson University, M.D. 1954, followed by Internship and Residency in Medicine, Philadelphia General Hospital, Research Fellowship Cardiology, Stanford University Medical School, 1959-60. Radiobiology Research, Lieutenant US Navy, U.S. Naval Radiological Defence Laboratory 1956-7 Practice and teaching of Medicine, 1960-93 Emeritus Clinical Professor of Medicine, Stanford U. Pharmaceutical Research 1993-present. Began Ceramics studies 1989 and continued workshops each year under Rory Nakata, Dept Head. Summer Workshop, State University of New York (Alfred) 1999 and 2002, Directed by John Gill. Summer Workshop, Haystack, 2000, Directed by Chris Gustin.
5.Why do you combine glass & ceramics in your work?	I felt that the beauty of both media could enhance each other. Some of the basic elements are common to both clay and glass. Although told by the "experts" that the properties of the two were hostile and that the combination would not work, it presented a challenge to create new forms of beauty and leave a small footprint in "The Road Not Taken".
6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	I began the experiments around year 2000 and have sent a few images and can send more on request. In working out the firing techniques and extremes of temperature there were many "planned" failures in order to work out the proper program
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	The basic chemistry of clay and glazes in itself suggests that there should be a probably combination. The temperatures

	for vitrification of clay and for the preservation of the cut and designed forms of glass and for the preservation of the dichroic surface were the challenges.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Yes, Many (see above). Glass may be looked at as a surface decoration for ceramic or ceramic may be looked at as a canvas for glass. I prefer to look at the combination of the two as a blending which produces a new art form yet to be explored. Yes
Any additional comments	Many artists are safe and stuck in their own narrow expertise and are unwilling to explore new directions. This may be for economic reasons or because of lack of imagination. Growth is possible from failure. Failure is a part of exploration, but there is often a rainbow of color in the end.

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Alfred P. Spivack, M.D
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Almost all the glass is flint Bullseye art glass, opaque, translucent, lustre surface, and a variety of dichroic glasses. The clay is a variety of clays, mostly from Laguna, including Babu porcelain, B mix, Red 9-11, Soldate 60
2. What production methods do you use?	Wheel thrown and hand build. Glass cut on an electric ring cutter.
3. What type of kiln(s) and what firing schedule do you use?	Skutt electric 27" deep and 23" across. 5 ramp firing schedule as described in Ceramics Monthly, Feb 2007. The ceramics are glazed and fired before adding the glass. The glass firing is then a separate firing.
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	Lustre overglazes are used with the glass firing. The glass firing is kept under 1500 F. believe the lustre glaze acts as an extra bonding agent between the glazed ceramics and glass, although some of the glass firings are also done without the lustre glaze.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Wheel Thrown and hand built. The pieces are individual and non-functional, except for the covered bowls/vases where the inside glaze is food safe and are not cleaned in a dishwasher.
6. What is the inspiration or intent of for your work?	I was unable to find references or other such work of the type I am doing. I searched major glass and ceramic institutions and libraries and found no references or examples. As a retired physician and clinical professor of Medicine at Stanford School of Medicine. The research I did represented a way for me to leave a small footprint to help other artists and bring ceramic and glass art closer.
7. Where can examples of your work be found?	My work is in private collections in the USA and Korea. Examples can be provided on request. It is my personal pleasure and research project. I will attached recent paired images. (glass/glass and glass/ceramic)
8. Has you work been published, if so where?	1. Ceramics Monthly Feb 2007 2. American Ceramics Society Handbook Series: Surface Decoration: Finishing techniques, 2008 3. Both are available through the ceramics monthly website
9. Do you know of other artists working in this way?	No, I have found none on requests to major sites including the Corning Museum of Glass, Renwick Museum, State University of New York at Alfred.
Any additional comments	I will send these as separate attachments.

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Ron Starr
2.Area/Discipline(s)	Ceramic / Glass
3.Materials used in work	Ceramic / Glass
4.Training (please add date/year)	1974-76 High School Ceramics 1976-1980 University of Wisconsin BA Business Administration Minor Ceramic Art
5.Why do you combine glass & ceramics in your work?	I enjoy working with both materials. I like the flexibility and forgiveness of clay and it's earthy appearance. While glass has very little forgiveness it presents the incredible brilliance. Finally, I also use the glass as an extension of glazing but in a chunkier more dimensional form.
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	June 2004
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	The use of glass as chunkier dripping glaze effects. Some abilities to sculpt glass like clay.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	See above When combined hot-crazing of the glass and cracking of the ceramic; none, when combined cold.
Any additional comments	

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email Jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Ron Starr
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Ceramic-A.R.T Clay, Wisconsin, #108 Brownstone II Glass –Spectrum 96
2. What production methods do you use?	Clay, Wheel thrown and altered Glass- Sand Cast and Hand Sculpted
3. What type of kiln(s) and what firing schedule do you use?	Ceramic-Baily cart kiln 85 cubic ft. Glass Typical 32 hour casting schedule
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	No
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Non-functional, sculptural
6. What is the inspiration or intent of for your work?	My latest series is all glass and the direction is about nature, specifically the destruction of our nation's trees.
7. Where can examples of your work be found?	RonStarrArt.com
8. Has you work been published, if so where?	No
9. Do you know of other artists working in this way?	No
Any additional comments (If possible please attach your CV and artist's statement).	Since I've been working exclusively in glass the last 3 years. My CV and statement is only about glass. Please see the attached.

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Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Claire Phillips-Thomas
2.Area/Discipline(s)	Ceramics
3.Materials used in work	White earthenware casting slip with 20% added paper pulp. Glass (from different sources)
4.Training (please add date/year)	Sept 2006 - June 2009 - BA Honours Ceramics, Cardiff School of Art and Design, UWIC One days glass induction Training at Warm Glass probably March 2005 Small amount of slumping and a drip cast item during first year on Foundation Diploma (2004) Experiments using varied inclusions during second year in foundation (2005) No prior Art, Ceramic or Glass training.
5.Why do you combine glass & ceramics in your work?	There is an initial sense of order and control during the process of working in ceramics, also in the preparation of working with glass which I enjoy. Yet, paradoxically the way in which I use glass, it has a freedom of its own, which i can't fully harness. I think this contrast or meeting of opposites is partly why I am drawn to working with both glass and ceramics. I really enjoy the physicality and process of working with clay which I don't get from working with glass as I find the process too removed yet the end result is extremely tactile. I also love the contrast between the precise pierced forms I make and the fluid, transient drips of glass which flow from them, particularly the way in which the glass seems to come alive when light is introduced to it. The sense of touch is really important to me not just as a maker but also as part of the process of enjoying my work when it's finished. I am trying to provide both a visual and tactile sensory experience with my work and I feel that by combining both ceramics and glass that I am able to achieve that. But if I had to answer this question in a sentence, the answer would be: - because I feel compelled to combine them!

6.When did you start to combine glass and ceramics in your work? (Please add date/year/image)	My initial experiments began approx April/May 2008,
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	I suppose the techniques I have used do cross over in as much as I now have an awareness of how both materials behave at high temperature- for example ceramic ware will slump and change shape if fired too high without any additional support the same will happen with glass. I have also learned that that if allowed to cool too quickly this will cause cracking to occur in both materials. And to state the obvious, they are both fragile materials once fired and don't bounce when dropped! Generally for me I would say I have experienced opposites and contrasts as opposed to similarities when working with glass and ceramics, particularly when it comes to Kiln firing. I find that ceramic ware really doesn't like the way it is treated in a glass kiln once glass has been allowed to become almost molten on top of it. This has caused me lots of problems with the ceramic ware cracking as the glass cooled. I also feel clay is generally more predictable than glass but then that could be due to me being much less experienced in working with glass and I could possibly feel differently as my experience increases
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics? 9.What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	I suppose this can depend on how they are combined, but certainly in my practice, where I am also looking at touch as well as vision I there are similarities in the way they feel and look, both materials are smooth and cold to the touch and appear the same. Also for me the matt ceramic form is enhanced by the combination of the fluidity and translucency of the glass and it is this combination of opposites which is what really makes the pieces work. Yes
Any additional comments	I would be happy to put a cd in the post with some more images of my work as I can't remember which images I attached to my email this week! Please let me know if this would be helpful and if so to which address you would like me to send it.

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.
If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Claire Phillips-Thomas
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	I Initially experimented using float glass, moving on to glass nuggets and finally moved on to Bullseye coloured glass. I ordered two "student" packs from Warm Glass and then purchased a few larger sheets from a local supplier - Ashdowns Glass in Cardiff. I have been using white earthenware slip courtesy of Cardiff Ceramics Department!!! Since finishing my BA, I have now purchased some bone china casting slip which I also want to experiment with.
2. What production methods do you use?	I make plaster moulds into which I pour white earthenware casting slip to which I have added 20% paper pulp. When the clay is leather hard, I pierce it, making the holes through which I will slump the glass. I fire to bisque in a ceramic kiln and then finely sand to a satin smooth finish. I then place the glass in the desired position and fire in the Rohde glass kiln to a temperature of 838C. Once it reaches temperature, I watch constantly until I have created the drips I want.
3. What type of kiln(s) and what firing schedule do you use?	I Have been using a Rhode Kiln which has been purchased by the ceramics department at Cardiff School of Art and Design I loosely follow the slump firing schedule taken from the Warm Glass book by Beveridge, Domenech and Pascual and from advice given by my tutor. On - 2 Hours to 600c Hold – 1 Hour at 600c Speed heat to 838c Hold variable depending on glass used- anywhere between 10 -45 minutes. I am watching closely at this point and the decision made is a visual one. Vent till temperature stabilises at 560c Hold 1 hour at 560c Drop over an hour to 460c Leave to cool naturally. Cycle on average taking 11 hours to get to 200c when I will open kiln. (I haven't had any "proper" glass training so I am aware that this may not be totally "correct" procedure. I am sure that with more knowledge and experience, this could well change)
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies	I have been using bought coloured glass for now, but intend to experiment with plain glass and add lustres/ enamels and possibly other additions too. Because I pierce my clay, I found I had a lot of pre-

to make them more compatible?	firing breakages because of its fragility.To strengthen the pre fired clay I added 20% paper pulp to the slip which made it easier to handle in its pre-fired state. However, I still need to improve the strength and quality of the fired clay as this can still break quite easily. This is one of my next projects when I return to University in October to begin my MA.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	This is an interesting question and as yet I'm not really sure exactly where I fit in.!!! For my degree show, I fitted lighting behind my work, which would indicate a leaning towards functional, yet I don't consider myself as a lighting designer. I would probably best describe myself as a designer/maker I think my work probably fits in somewhere between sculptural and limited edition, but then again as each piece I make is similar yet different I'm not sure if I'm also touching on one off! As a new Graduate I am definitely keeping an open mind!
6. What is the inspiration or intent of for your work?	My intention is to create work which provides both a visual and tactile experience yet also offers a sensation of calm. Currently I am exploring the contrast between solid, bisque fired clay and transparency of fluid drops of glass. I am a keen photographer and take lots of images-ranging from architectural to natural. The common denominator in these images is what I loosely describe as "lumps and bumps and holes", and objects which represent drips. I am also becoming more aware of the importance of repetition in both the photographs I take and the pieces I make. Water inspires me too- whether it is the sea, rivers, raindrops, dew or ice. In working with the glass through the ceramics I am trying to capture forever the moment which is lost for ever in daily life, I guess I am trying to provide a visual image of a split second in time.
7. Where can examples of your work be found?	Images of my work can be found on my website :- clairephillipsthomasceramicsandglass.moonfruit.com As a new graduate I am currently looking to try and get my work exhibited.
8. Has you work been published, if so where?	I haven't had any work published, but I am considering writing an article and seeing if any of the ceramic or glass magazines may be interested.
9. Do you know of other artists working in this way?	I haven't found anyone yet who is doing exactly the same work as I am. I haven't found many other artists who are working with both glass and clay. Andrea Walsh is one and of course yourself.
Any additional comments (If possible please attach your CV and artist's statement).	As a new graduate, I am still to a certain extent "feeling" my way.I have got the beginnings of a workshop in my garage with a very small ceramic kiln but as yet I don't own a glass kiln and unfortunately at the moment I'm not in a position to be able to afford one, especially as I intend returning to University to take my MA in ceramics. Initially I think I may have to downsize on what I am making and experiment a bit with the glass in my ceramic kiln and just accept that I won't be able to have as much control as I would like.

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 1 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Andrea Walsh
2.Area/Discipline(s)	Glass & Ceramics
3.Materials used in work	Slip cast bone china (Valentines) with paper pulp and cast glass – gaffer/bullseye
4.Training (please add date/year)	BA Fine Arts Staffs University 1995-1998 International Glass Centre, Dudley, 1 Year Tech Course 2000 M.Des Glass ECA 2001-2002
5.Why do you combine glass & ceramics in your work?	I am intrigued by materials, I explore the inherent qualities of both glass and ceramics in my work. Both have similar qualities echoed in each material which are complimentary. The alchemical qualities of the materials are also an intriguing process. Experimentation and discovery give me the passion to find out more.
6.When did you start to combine glass and ceramics in your work? (Please add date/year)	2001
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	I have only ever worked in Bone china, as it has specific requirements that suit my working style – as large forms tend to have restrictions in scale. Similar processes and characteristics of materials are echoed in each other. The distortion or movement present in both materials when fired as well as the transformation in the kiln are similar. Also the way hot glass flows is similar to bone china.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	Yes see above
9. What technical difficulties (if any) have you experienced in combining glass and ceramics in your work?	Not combined in hot state, cold state create complimentary elements which appear as one whole.
Any additional comments	

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Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 2 Case Study

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

Thank you for taking part in my research that is currently being conducted at the University of Sunderland into the combination of glass and ceramics in studio practice. If you could answer the further questions below which have arisen I would like to include the answers alongside the questions and images you have previously sent through to provide an in depth study of your work.

Practitioner's name	Andrea Walsh
1. What type of glass and ceramics do you use? (Please state supplier and product name if possible).	Valentines Bone china and Gaffer Glass/Bullseye casting glass.
2. What production methods do you use?	Casting glass & slip casting bone china. Hand apply slip building up in layers, which are then smoothed by hand and burnished. Due to my work being very fragile in the green state all the work is biscuit fired and then refined with wet and dry and diamond pads. The ceramic is then high fired and then the glass (often prefired as well) is set into the ceramic and fired to fit into the ceramic, thin fire is used between the two materials and the base is set into a mould. The glass is then fire polished and the base is ground flat to about 120.
3. What type of kiln(s) and what firing schedule do you use?	Electric kilns, fired 3- 4 times. 1000 biscuit, 1250 High fired, 850 gaffer or 750 bullseye
4. Do you use any other materials in your work? Or add any extra materials to your glass or ceramic bodies to make them more compatible?	Not currently, however during BA was interested in furniture and metal work – learnt about lead and bronze casting.
5. What is the style of your work? i.e. sculptural, functional, one off, limited edition or batch.	Sculptural (non functional) One off Ceramic is a means of containing the glass – as a vessel for firing into
6. What is the inspiration or intent of for your work?	Fine art background has inspired approach to materials and what glass and ceramics signify in the object, linked to material symbolism and the connections they have.
7. Where can examples of your work be found?	Galleries such as Open Eye, Edinburgh, CAA, London etc. Taking part in the Stoke on Trent Ceramic Biennale: residency with Staffs University and Minton.
8. Has you work been published, if so where?	Ceramic Review Jan/Feb 08, AN Supplement Collection + various photo shoots/articles. Craft Scotland DVD
9. Do you know of other artists working in this way?	David Binns
Any additional comments	See website Photography credit Shannon Toffs

Thank you for completing this questionnaire, if you need anymore information please get in touch with me directly by email jessamy_kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions.

Questionnaire 3 Case Study

A ceramic aesthetic in blown glass

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Paula Bartron
2.Area/Discipline(s)	Glass
3.Materials used in work	Glass mainly
4.Training (please add date/year)	University of California, Berkeley, California Bachelor of Arts in Ceramics and Glass 1970 University of California, Berkeley, California, Master of Arts in Glass 1972 Orrefors Glass School 1973-1974 3 school terms.
5.Have you ever combined glass & ceramics in your work?	As a student I made some work using both materials that were unsuccessful. I realized that they were so similar that they fought each other for dominance in the work and neither won. I had used glass and a white-grey porcelain.
6. If so, when did you start to combine glass and ceramics in your work? (Please add date/year/image)	1968 I doubt if I have any images of the pieces. They were fairly awful, so I wanted to disown them.
7.What similarities or links have you experienced in the working of glass & ceramics in your work?	Maybe the obvious. Similar chemistry. Glazes are glass. They have to be compatible with the clay otherwise they crack off. Compatibility problems with glass colours. Both in blowing and throwing the material rotates to be kept on center. Both glass and clay can take on any form and almost any colour
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	They are too similar and fight to dominate the other in a piece. That is why I choose not have them in the same work.
9. Do you work mainly in glass but employ an aesthetic that could be seen as having a ceramic look or style?	Ceramics is still there without being there. Much of the glass I make looks like clay, or has the feeling of clay. Some of the pieces are blown in sand moulds, deformed and covered with powdered glass, acid etched, etc It is opaque or has the rough look of sand, clay, sometimes iron. The translucence shows when the work is lighted from the side. Other work is cast in sand, sawed, and fused into new forms and sometimes slumped. The sandy rough surface reminds

	me of clay.
10.In regards to question 9, do you feel this has links to your training or your general approach to materials?	It probably does. The process is interesting and similar. Throwing and blowing are quick. Decisions have to be made quickly. The result comes out relatively fast although ceramics takes longer, glazing, firing. Glass comes out of the annealer the next day mostly. Cast glass is a longer process and nice to switch back and forth. Sometimes building, casting, working on projects that take time. Decisions can be made along the way. Thoughtful contemplative. Blowing done either alone or with others is fast. Throwing is also fast. Nice to choose and be able to switch back and forth.
11. Do you know of other artists working in this way?	Many artists have had a ceramic look to their glass. Early on in the studio glass movement most people who got into glass came to it from ceramics. That is how it worked for me.
Any additional comments	

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com
Please use this sheet attached for any further comments, or elaboration on questions. If possible please include images of your artworks that combine glass and ceramics.

Questionnaire 3 Case Study
A ceramic aesthetic in blown glass

Jessamy Kelly
Glass & Ceramics PhD research student at the University of Sunderland

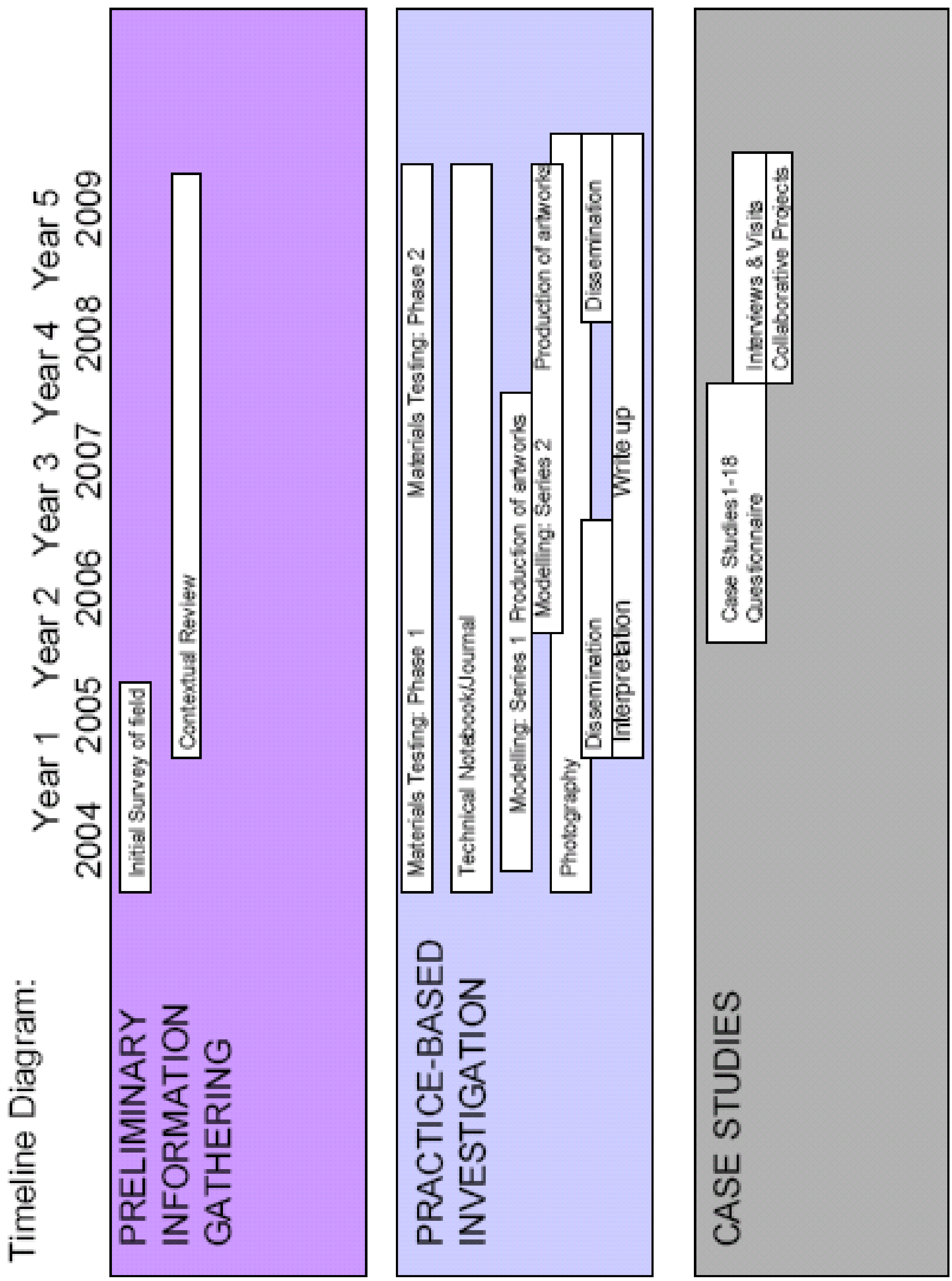
I have chosen your work because it is of interest to my research, currently being conducted at the University of Sunderland. My research is investigating the combination of glass and ceramics in studio practice. If you could answer the questions below, I would like to include the answers and some images of your work in a case study I am completing as part of my research study.

1.Practitioner's name	Criss Chaney
2.Area/Discipline(s)	Glass (cast and blown)
3.Materials used in work	Glass, Metal powders
4.Training (please add date/year)	BA (Hons) University of Sunderland 2006
5.Have you ever combined glass & ceramics in your work?	Yes
6. If so, when did you start to combine glass and ceramics in your work? (Please add date/year/image)	I did some tests with non glass materials during my BA. During 2005
7. What similarities or links have you experienced in the working of glass & ceramics in your work?	When I was combining them I tried to think of ways to combine them that would use predominately glass techniques, but where glass and ceramic overlapped in terms of process. So for example I used blown glass and coated it with wet slip, then 'fired' it in the glory hole.
8. Do you think that there are any particular aesthetics associated with combining glass and ceramics?	In my own work I try to bring in the contrast between the natural, earthy, rough, and opaque qualities of the ceramics with the smooth, sleek, modern, and transparent qualities of glass.
9. Do you work mainly in glass but employ an aesthetic that could be seen as having a ceramic look or style?	Yeah, I work predominately in glass, using mostly glass techniques for combining the two materials. Even when I use metals instead of ceramic people mistake the works for ceramics, even after close inspection.
10. In regards to question 9, do you feel this has links to your training or your general approach to materials?	I think my training was much more about concept than technique, but obviously the material was important as it is the basis for my ideas. The thing that has always interested me about glass is the challenge inherent in working with the material, and I've always enjoyed pushing the boundaries of what I've been told can't be done, with a process or material. Suppose my current work with combining materials is a result of dark and subdued aesthetic as we as me just being ornery.
11. Do you know of other artists working in this way?	I definitely find Colin Reid interesting, but he doesn't seem to push the combination of materials very far. I also enjoy Clifford Rainey's work for its dark aesthetic and he has been known to incorporate other materials in his glass and cause it to react.
Any additional comments	

Thank you for completing this questionnaire; if you need anymore information please get in touch with me directly by email jessamy_Kelly@hotmail.com

Appendix 13: Timeline diagram

Visualisation of methods used and their relationship to each other



Appendix 14: Overview Tables of Case Studies

Table 13 Overview of information from case studies A – E

	Anderson	Binns	Branfman	Delsol	Etsuko
Types of Glass & Ceramics used	Continental Clay Raku clay body Furnace Glass	Range of ceramic materials found minerals in aggregate / granular form, glass & more recently recycled waste glass	Ceramic raw materials (glaze), stoneware clay, Laguna #250:Laguna Clay, USA and coloured sheet glass	Optical Glass from Corning & ceramics from Céradel	Glass cullet from Santoku co & ceramics from Kaneri
Hot or Cold state combination Process Route	HOT Route 4	HOT Route 3	HOT Route 1	COLD N/A	COLD N/A
Other materials used	No	Yes – Concrete	No	Yes – grog & vermiculite	No
Style of work	Sculptural	Sculptural	One off Vessels	Sculptural	Sculptural
Production methods	Wheel thrown, glazed, raku fired, hot glass	Casting, moulding	Throwing, inlay, glazing	Hand building, glass casting, cold working	Slab building, glass casting, cold working & gluing
Kiln Type	Electric Kiln Gas - Raku	Electric Kiln	Electric Kiln Gas - Raku	Electric kiln Wood - Raku	Electric kiln
Firing Schedule/ Temperature	Cone 7	1180°C	Raku fired	Glass: 880°C Ceramic: 1000°C	Glass: 880°C
Technical difficulties	Yes - cracking	No	No	No	No
Date first combined Glass & Ceramics	2002	2000	1996	1990	1992

Table 14 Overview of information from case studies F - M

	Fontaine	Gudjons-dottir	Kelly	Lemaire	Mulcahy
Types of Glass & Ceramics used	Amand Saint stoneware & grog, porcelain slip & furnace glass	Ceramic & cast glass	Gaffer blowing & casting glass Philips Furnace glass Potterycrafts Bone China slip & Valentines Porcelain slip + paper slip + quartz	Stoneware high-alumina clay body made from Continental Clay & lamp worked borosilicate glass	Ceramic body with added perlite & Blackwood Casting Crystal
Hot or Cold state combination	COLD	COLD	HOT	HOT	COLD
Process Route	N/A	N/A	Route 2 & 3	Route 2	N/A
Other materials used	Yes - electric insulators	metal & stone	No	Silver, found wood, encaustic, brass & live plant matter	Metal, found objects
Style of work	Sculptural	Sculptural	Sculptural	Sculptural	Sculptural
Production methods	Moulding, casting, extrusion, modelling	Hand building, casting	Slip casting, glass casting, coldworking, glassblowing	Hand building, lampworking	Hand building
Kiln Type	Gas kiln	Electric Kiln	Electric Kiln	Electric Kiln & soda kiln	Electric Kiln
Firing Schedule/ Temperature	Reduction	Glass casting schedule	Biscuit 1000°c High fired 1280/1250°c Glass 790°c - 825°c Fuse 650°c -700°c	Ceramic: Cone 10 Glass: 838 °C To heat up Lampwork 525 °C to anneal	12 stage programmer as thicker ceramic components can take several days to fire
Technical difficulties	No	No	Yes, but most have been resolved	Yes – relating to compatibility	Yes – related to moulding fit
Date first combined Glass & Ceramics	1990	1993	2000 – Cold 2004 – Hot	2004	2001

Table 15 Overview of information from case studies 0 - S

	Osbourne	Roberts	Rockriver	Spivack	Starr
Types of Glass & Ceramics used	Bone china & Porcelain Frit from furnace & warm glass	3mm float glass & black scarva clay bodies	Glass: System 96 Olympic Color Rods: frit, sheet, cullet, casting billets. Ceramics from Bailey Ceramics with soda flux	Flint Bullseye art glass, opaque, translucent, lustre surface & dichroic Laguna clays: Babu porcelain, B mix, Red 9-11, Soldate 60	Ceramic- A.R.T Clay, Wisconsin, #108 Brownston e II with Spectrum 96 Glass
Hot or Cold state combination Process Route	HOT Route 2	COLD N/A	HOT Route 2 & 4	HOT Route 2	COLD N/A
Other materials used	No	No	Sand, Salt, Soda, Epoxy	No	No
Style of work	One off vessels	Sculptural	Sculptural	Non-functional vessels	Sculptural
Production methods	Slip casting	Hand building, lineshing	Hot glass blowing, Kiln Casting, hand building	Wheel thrown & hand build. Glass cut on an electric ring cutter Glazing	Wheel thrown & altered Sand Cast glass Hand Sculpted
Kiln Type	Electric Kiln	Electric Kiln	Electric	Electric	Electric
Firing Schedule/ Temperature	1250°C or 1280°C	Ceramic high fired Glass fused	950°F - 2350°F	5 ramp firing schedule Glass Fusing: 1500 °F Annealing 950 °F	32 hour casting schedule
Technical difficulties	Yes – relating to compatib-ility	No	Yes – relating to compatib-ility	No lustre glaze acts as an extra bonding agent between the glazed ceramics and glass	Yes – relating to compatib-ility Not in cold state
Date first combined Glass & Ceramics	2004	2008	1993	2000	2004

Table 16 Overview of information from case studies T - W

	Thomas	Walsh
Types of Glass & Ceramics used	Bullseye coloured glass & white earthenware slip with 20% added paper pulp	Slip cast bone china (Valentines) with paper pulp and cast glass – gaffer/ bullseye
Hot or Cold state combination Process Route	HOT Route 2	COLD N/A
Other materials used	No	No
Style of work	Sculptural	Non – Functional Vessels
Production methods	Slip casting, glass casting	Slip casting, glass casting
Kiln Type	Electric	Electric
Firing Schedule/ Temperature	838°c	1000°c biscuit, 1250°c High fired, 850°c gaffer or 750°c bullseye
Technical difficulties	No	No – Not in cold state
Date first combined Glass & Ceramics	2008	2001

Glossary

Aggregate	Materials used as solid additions, for example to ceramic bodies.
Alumina	Aluminium oxide
Aluminosilicate Glass	A type of glass that contains 20% aluminium oxide and often includes calcium oxide, magnesium oxide and boric oxide in relatively small amounts.
Annealing	A process used to reduce stress in molten glass by allowing the glass to cool to a annealing point at which it is held for a length of time relating to its thickness.
Beinglas	Bone glass, German term for white or opaline glasses.
Biscuit fired	Temperature at which air dried ceramic is initially fired.
Bisque	As above
Blown Glass	Glass objects created through the glassblowing process.
Bone China	A clay body usually made up of 50% bone ash and equal parts of china clay and feldspar.
Borosilicate Glass	A type of glass that contains mainly silica (70-80%) and boric oxide (7-13%) with smaller amounts of alkalis (sodium and potassium oxides) and aluminium oxide.
Carborundum grit	An abrasive material made by heating sand, coke, sawdust and salt to high temperatures.
Cast/Casting	By pouring molten glass into a pre-heated mould, or by melting glass in a crucible from and pouring it into a mould or by heating both mould and glass together until the glass takes up the form of the mould.
Centrifuge	A machine that shapes hot glass by using centrifugal force to spread the glass against the inside surface of a rotating mould.
Ceramics	Pottery objects, refractories, bricks, tiles etc. produced by the process of forming and firing clay.

Clay	A material made up mainly of alumina and silica, although it’s content and form varies dramatically depending on its source.
Clay body	A type of clay, such as bone china or porcelain.
Co-efficient of expansion	A numerical formula that is a measurement of the increase in size in relation to temperature change.
Cold state	Techniques or processes which are carried out without heat e.g. uv gluing or cold laminating.
Compatibility	With reference to glass and ceramics, related to differences in co-efficient of expansion rates between materials that causes visible cracks or stresses when they are heated together.
Core formed/ core forming	An ancient Egyptian method used to make hollow forms before glassblowing was developed.
Crackle glaze/ glazing	Glazes that shrink on cooling to create a crackle or crazed effect.
Crystal	A type of glass made with lead oxide as a major flux, also known as lead crystal.
Crystalline	A material composed of crystal/crystals that has a crystal lattice, a regular pattern of atoms, ions or molecules e.g. ceramics.
Crystallization	When glass cools it often tries to regain a more regular crystal lattice (see above), if the glass is held at its liquidus temperature crystals of devitrite can be formed; which can cause visible stresses or cracks.
Devitrification	See above
Diamond cut/ cutting	A decorative technique which uses diamond impregnated abrasive tools: wheels, drills points, discs, belts are used to cut into the surface of glass (or in the case of this research ceramics).
Dichroic Glass	A type of coated glass that is usually clear in colour which has been coated with various chemicals to give it a silvery coating on the reflected surface.

Egyptian Faience	A type of non clay ceramic made up mainly of quartz or sand which was made into beads that looked like precious stones.
Egyptian Paste	An ancient Egyptian material that I one of the earliest form of glaze found on ancient objects such as beads and amulets.
Earthenware	See Terracotta
Enamel/enamelling	A decorative technique, which is created by fritting glass with colourants and fluxes which are then applied to glass or ceramic objects
Engraved/Engraving	A decorative technique, which using diamond or copper wheels or points to cut into the surface of glass.
Fibre paper	A type of paper which is used in kiln casting to stop the glass from sticking to the kiln shelf or any other surface in the firing.
Flint	See Quartz
Float glass	Sheet glass which has been made by floating a ribbon of hot glass on a bath of molten tin.
Flux/Fluxing	In glassmaking this refers to an oxide which interacts with other oxides to promote fusion. In ceramics this refers the effect two or more oxides have on one another to lower the temperature at which they begin to melt.
Frit	In glassmaking this refers to a batch material which has been melted and then ground.
Furnace	A refractory pot that is filled with glass and heated up to create molten glass for glassblowing.
Fuse/Fusing	A technique which heats pieces of glass until they are fused together.
Glaze/Glazing	A thin layer of glass, which is applied to a biscuit fired ceramic.
Glass	A material composed of crystalline materials that through heating transform silica, soda ash and lime into an amorphous non-crystalline solid.

Glass blowing	A technique that forms molten glass gathered from a furnace into glass objects.
Glass-ceramics	A type of glass formed typically from lithium aluminosilicate glass, which is extremely resistant to thermal shock and have a low or even negative coefficient of expansion.
Glass Fibre	A material that has many uses from roof insulation to medical equipment, its composition varies depending on its application. For building insulation and glass wool the type of glass used is normally soda lime. For textiles and reinforced plastic an alumino-borosilicate glass with very low sodium oxide content is used.
Green state	When clay is still in a wet form, before it has been air dried.
Grog/grogged	Particles of fired refractory material used to reinforce clay or plaster casting moulds.
Hand built	Clay objects made by hand (not on a potters wheel) using various techniques such as coiling, slabbing.
Hard paste	A type of porcelain that can be high fired and is usually made up of 50% kaolin or china clay and balanced equal parts of potassium feldspar and quartz.
Hot fritting	A technique used to make glass frit, molten glass is ladled straight from the furnace into cold water.
Hot glass	Term used to describe a glass technique which is made by glassblowing.
Hot state	Techniques or processes which are carried out using heat e.g. casting, blowing, fusing etc.
Inclusion	A term for materials or bubbles incorporated into glass objects.
Inlaid/Inlay	Small (coloured) glass or ceramic pieces/slips embedded into glass or ceramic objects.
Kiln cast	See cast/casting
Kiln glass	Glass objects created using the kiln casting process.

Lampwork/Lampworking	Glass objects created using the flameworking process, glass is manipulated at a bench using flame torch.
Leather hard	When clay is still in a wet form, bit it has been partially air dried and can be handled with care.
Linished/ linishing	A technique use to grind and polish glass, using a machine which has belts coated with abrasive grains or cork.
Lost wax	Cire perdue, a technique where a wax form is cast into a mould, the wax is then steamed out and dried; glass is then melted into the space left by the wax.
Malachite	Calcined china clay used as an investment material in mould making and is often used to reinforce refractory clays for making glass pots.
Milk glass	See opaline glass.
Mould	The negative form into which glass is cast or blown into; often made from metal, graphite or wood for glassblowing or plaster or other investment materials for kiln casting.
Non crystalline	A material not composed of crystal/crystals, e.g. glass.
Opal/Opaline glass	Any glass with a white, milky appearance.
Oxides	A combination of oxygen with another element, essential to glass and ceramics processes. There is a wide range of colouring oxides which are used to colour glass batch or for glazing.
Paper clay	Clay which contains paper pulp.
Paper pulp	Paper which has been broken down in water, which is then added to clay to create paper clay.
Parian	A type of clay that is made up of porcelain body to which ground bone china and feldspar are added to create a soft paste, unglazed body which does not require glazing. A white statuary material used for sculptural moulding.

Pâte de verre	A paste of glass, a technique which derives from Phoenician and Egyptian times, which was revived by French artists in the 19th century. The term generally describes a wide range of cast glass objects.
Plaster	Made from gypsum, which is heated until the water of crystallisation has been driven off; a semi hydrated calcium sulphate. The white powder is added to water and mixed, crystals form and it hardens, returning to a similar state of the original gypsum to create mould investments.
Polish/Polishing	Glass can be polished by heat or fire polishing, by eroding the surface with varying grades of abrasive particles or by eroding the surface with acid.
Porcelain	A type of clay that can be high fired, usually made up of 50% kaolin and balanced equal parts of quartz and potassium feldspar.
Porcelain glass	See opal glass.
Press moulded/moulding	A technique which forms glass by pressing molten glass between a plunger and a mould.
Punty	A small gather of hot glass which is gathered on a bit iron and transferred to the base of a blown glass object which can then be knocked off and the rim finished off by further heating.
Quartz	Most common form of mineral silica, it is a source of white sand when it is has disintegrated, when this is ground down it provides batch silica. Powdered quartz is sometimes used as an investment material in mould making. See silica, silica inversion.
Raku	A method glaze firing, biscuit fired objects are fired until the glaze has matured, the objects are taken from the kiln and allowed to oxidise in he air or by plunging them into cold water. To achieve a reduction the objects are plunged into saw dust creating a smoky oxygen reduced atmosphere.
Reduction	See raku
Refractory	Materials which can withstand high temperatures.

Sandblast/Sandblasting	A decorative technique which uses compressed air which projects an abrasive material which penetrates the surface of glass (or in the case of this research ceramic) to create a matt, or eroded surface.
Setter	A ceramic mould which is fired with a ceramic object so that it retains it's original form, or in the case of this research a ceramic object which has been high fired and then additionally fired with a layer of glass.
Sheet glass	See float glass
Silica	Silicon dioxide, silica is melted on its own to make silica glass. As a batch material silica is the principal glass former, nearly all commercial glass has silica as it main constituent.
Silica glass	Vitreous silica glass, fused glass. See vitreous glass.
Slab built	Clay objects made out of slabs of rolled out clay and joined together with clay slip.
Slip cast	A ceramic process which involves liquid clay slip being poured into a plaster mould, the moisture from the clay is pulled into the plaster mould, when the desired thickness has been achieved the surplus slip is poured out and a skin of clay is left.
Slump/slumping	A technique which heats glass until it bends to a shape defined by the containing mould or by supporting wires or rods.
Soak time	A time this is programmed into a glass or ceramic kiln, which holds the kiln at a given temperature for a given time.
Soda Glass	Soda lime silica glass, a type of glass which uses soda as its major flux.
Soft paste porcelain	A type of porcelain that fires lower then hard paste porcelain, it is usually made up of 50% kaolin and balanced equal parts of china clay and feldspar.
Stoneware	A type of clay with a low calcia content, which means it can be vitrified and fired at high temperatures.

Terracotta	A type of clay that fires to a rich red brown colour, and fires at a low temperature.
Thermal expansion	This refers to the amount by which a material expands according to the effect of heat, see coefficient of expansion.
Thermal shock	The effect on a material of rapid temperature change.
Trail	A method of producing lines of glass on a form (usually coloured) by winding soft threads of glass around it.
Translucency	A material which allows light to partially pass through it.
Transparency	A material which allows light to pass through it.
UV glue	Ultra violet glue, a type of glue which is set off by an ultra violet light source.
White gold	A term used to describe porcelain.
Vitreous Silica	A type of Silica glass which has a very low thermal expansion. This glass is porous and contains tiny holes created using acids and is used for filtration.

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