Possibilities of combining ceramics and recycled glass for decorative lighting design

ความเป็นไปได้ในการผสมผสานศิลปะเครื่องเคลือบดินเผา และศิลปะแก้วรีไซเคิลเพื่อการออกแบบแสงสว่าง

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Abstract

This paper is part of a practice-based research which aims to experiment with the possibility of combining ceramics and recycled glass for decorative lighting design. Both materials share similar characteristics with regard to passage of light and their translucency and they both exist in the same group of materials; compounded by the same inorganic substances and with which when treated with heat exhibit a very similar transformation process. However, they are structurally different resulting in varying rates of expansion and shrinkage. This creates incompatibility problems, in the form of excessive cracks or stresses when they are combined.

A pure practice based process was implemented to identify potential compatibility and combining techniques. The development of these techniques were based-on a review of relevant literature by a total of 53 ceramic and glass artworks by designers and artists worldwide into 3 possible processing routes of new exploration. Quartz added bone china clay body was identified and used for the exploration due to its transparency quality and compatibility with glass. Recycled glass bottles and window glass were used because glass is ideal for recycling since none of the material is degraded by normal use. Glass bottles and jars are 100% recyclable and can be recycled endlessly without any loss in purity or quality. The kiln-formed techniques; fusing, slumping and casting will be used to create the prototype

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artwork. For this prototype inspiration will be drawn from “Star ceiling: patterns and elements from Thai Traditional Architecture” and a simplified version of this element will be used in the design to make a contemporary artwork while at the same time maintaining a sense of Thainess and reflecting the artistic identity of the researcher.

The results of the exploration can be concluded that there are possibilities of combining ceramics and recycled glass and the result of this research will be used to create a new visual language and aesthetic value in the combining of ceramics and recycled glass for lighting design in various ways such as Light Art Installations, Decorative Lighting Design etc. Furthermore, this research is expected to raise society’s awareness and aesthetic appreciation of ceramic and recycled glass design which will be able to benefit the further development of creative art and eco-friendly design products in the future.

Keywords: ceramics/ recycled glass/ kiln-formed technique/ lighting design

บทคัดย่อ

บทความนี้เป็นส่วนหนึ่งของการวิจัยซึ่งมีวัตถุประสงค์ที่จะทดลองและสร้างสรรค์ความเป็นไปได้ในการผสมผสานเครื่องเคลือบดินเผาและแก้วเข้าด้วยกันเพื่อการออกแบบแสงสว่างเนื่องจากคุณลักษณะเฉพาะร่วมกันของเครื่องเคลือบดินเผาและแก้วที่มีความเกี่ยวข้องกับแสงและความโปร่งแสง เครื่องเคลือบดินเผาและแก้วสามารถจัดอยู่ในกลุ่มวัสดุเดียวกัน ประกอบด้วยสารอนินทรีย์เหมือนกันและใช้ความร้อนในกระบวนการเปลี่ยนแปลง อย่างไรก็ตามเครื่องเคลือบดินเผาและแก้วมีลักษณะโครงสร้างที่แตกต่างกัน สัมพันธ์กับอัตราการขยายและหดตัวที่แตกต่างกันซึ่งทำให้เกิดปัญหาความเข้ากันไม่ได้ ทำให้เกิดรอยแยกหรือการแตกร้าวเมื่อรวมเข้าด้วยกัน

กระบวนการทดลองได้ดำเนินการขึ้นเพื่อแสวงหาเทคนิคที่มีความเป็นไปได้ในการผสมผสานวัสดุทั้งสองเข้าด้วยกัน โดยค้นคว้าและวิเคราะห์จากผลงานศิลปะเครื่องเคลือบดินเผาและแก้วของศิลปินและนักออกแบบจากทั่วโลก รวมทั้งหมดจำนวน 53 ผลงาน สามารถแบ่งออกได้เป็น 3 แนวทางในการทดลอง และกำหนดให้ใช้ดินโบนไชน่าที่มีการเพิ่มควอทซ์ เนื่องจากสมบัติด้านความโปร่งแสงและความเข้ากันได้กับวัสดุแก้ว และใช้วัสดุเศษแก้วและกระจก เนื่องจากเป็นวัสดุที่สามารถนำมารีไซเคิลได้100% โดยไม่มีการเปลี่ยนแปลงของสมบัติของวัสดุเลย การทดลองใช้เทคนิคการขึ้นรูปด้วยเตาเผา(Kiln-formed techniques)ได้แก่ การหลอม(Fusing) การเปลี่ยนรูปทรง(Slumping) และการหล่อ(Casting) โดยการสร้างสรรค์ผลิตภัณฑ์ต้นแบบได้รับแรงบันดาลใจจาก “ดาวเพดาน: รูปทรงและองค์ประกอบจากสถาปัตยกรรมไทย” ใช้การลดทอนรายละเอียดขององค์ประกอบแบบไทยเพื่อสร้างสรรค์ผลงานที่มีความเรียบง่าย ร่วมสมัยสื่อถึงความเป็นไทยและแสดงถึงอัตลักษณ์ทางศิลปะของผู้วิจัย

ผลจากการทดลองสามารถสรุปได้ว่ามีความเป็นไปได้ในการผสมผสานศิลปะเครื่องเคลือบดินเผาและศิลปะแก้วรีไซเคิล และผลจากการวิจัยครั้งนี้จะนำไปใช้สร้างสรรค์ผลงานการออกแบบแสงสว่างที่มีคุณค่าและความงามในรูปแบบใหม่ของการผสมผสานศิลปะเครื่องเคลือบดินเผาและศิลปะแก้วเข้าด้วยกัน ยกตัวอย่างเช่น การจัดวางแสงสว่าง การออกแบบผลิตภัณฑ์เพื่อการตกแต่งด้วยแสง เป็นต้น นอกจากนั้นผู้วิจัยคาดหวังว่าการวิจัยนี้จะทำให้เกิดการตระหนักรู้คุณค่าและความงามของศิลปะเครื่องเคลือบดินเผาและแก้วรีไซเคิล ซึ่งจะสามารถก่อให้เกิดการพัฒนาสร้างสรรค์ผลิตภัณฑ์ศิลปะและการออกแบบที่เป็นมิตรกับสิ่งแวดล้อมต่อไปในอนาคต

คำสำคัญ : เครื่องเคลือบดินเผา / แก้วรีไซเคิล/ เทคนิคการขึ้นรูปด้วยเตาเผา/ การออกแบบแสงสว่าง

Introduction

Ceramic art and Glass art both have a long and a rich history of many thousand years that express the prosperity of art & culture due to their amazingly versatility of these materials and their manufacturing process. In ceramic arts it was discovered that intense heat could transform clay into a material of great durability, from this point onwards, exploration of the practical possibilities of the material went hand in hand with development of its aesthetic potential.

Clay is an extraordinary substance: very plastic and malleable, it can also be poured as liquid or carved and scraped in a dry state. Many decorative techniques can be applied in clay such as painting with under glazed / over glazed color. The discovery of glazes makes vessels impervious to liquid. Clay fired under a wide range of firing temperatures from earthenware to porcelain can be decorated with suitable glaze and firing techniques. (Dormer, 1994)

Ceramic objects encompass a diverse range of possibilities which extend from functional / useful pieces that continue a long tradition to works that have no concern with function. Many sculptors nowadays use ceramic as a medium to express their creativitiy. “Clay is an ideal medium for those who want to make arbitrary gestures and marks on it. Very often it is allowed to take control of the maker and is used as a free vehicle for intuitive expression.” (Dormer, 1994, p.40)

Glass is an amazingly versatile material with magical, mysterious, and illusory characteristics. Glass is a mixture of the most common materials (sand, chalk and wood ash) that can be transformed by fire into a unique transparent solid with marvelous optical qualities. It becomes more fluid as temperature rises, until at around 1000°C it can be manipulated in a variety of ways. Molten glass can be blown, stretched and drawn into threads, poured, rolled flat

or cast into sheet or blocks. These can then be fused, bent or molded in a kiln and when cold can be cut sawn, drilled, carved, etched, engraved, polished, painted or laminated. Forms and images can be suspended within it, or magnified through it. It can be toughened and colored and it has ability to hold, transmit, bend, reflect, diffused or reflected light. (Layton, 1996)

Ceramic and glass can be said to belong to the same group of materials because both are compounded by the same inorganic substances and are transformed radically by application of heat. However the main difference between the two is glass have to be in molten state before forming while in ceramics, the clay needs to be formed first before heating and then the glaze is heated again to melt into the clay body. Ceramic glaze is made from the same basic substances of glass to coating the clay surface.

Across the world, everybody realizes the impact of excessive human consumption and growth on the environment; which has resulted in global warming, environmental disasters and energy problems. A sustainable approach to making, consuming, recycling or even up-cycling products is one possible way to reduce the environmental impact of human consumption. This research builds on the approaches and concepts of sustainability, that is, to use recycled glass, conserve raw materials, reduce energy consumption to develop innovative designs and contribute to the development of new knowledge

Glass recycling facts: Glass is ideal for recycling since none of the material is degraded by normal use. Glass bottles and jars are 100% recyclable and can be recycled endlessly without any loss in purity or quality. Recycled glass can be substituted for up to 95% of raw materials. Recycled glass is always part of the recipe for glass, and the more that is used, the greater the decrease in energy used in the furnace and benefiting the environment.

Objectives

This study aims to research the possibility of ceramics and recycled glass combination for innovative lighting design due to the shared characteristics of ceramic and recycled glass related with light and translucency. The objectives of the research are as follows;

1. To understand materials and production process of ceramic and recycled glass.

2. To experiment and create new possibilities for combining ceramic and recycled glass keeping in mind the principles of eco-friendly design.

3. To create a new visual language and aesthetic value of combining ceramic and recycled glass for lighting design.

Methodology

Practice-Based Research

Research in Art and Design

-To understand material and process and identify the possibilities of how to combine ceramic and recycled glass.

-To study and develop new visual language and aesthetic value of combining ceramic and recycled glass

Pure practice

-To experiment materials and process of ceramic and recycled glass for potential compatibility and combining techniques.

-To express the concept design and create innovative design of combining ceramic and recycled glass for lighting design.

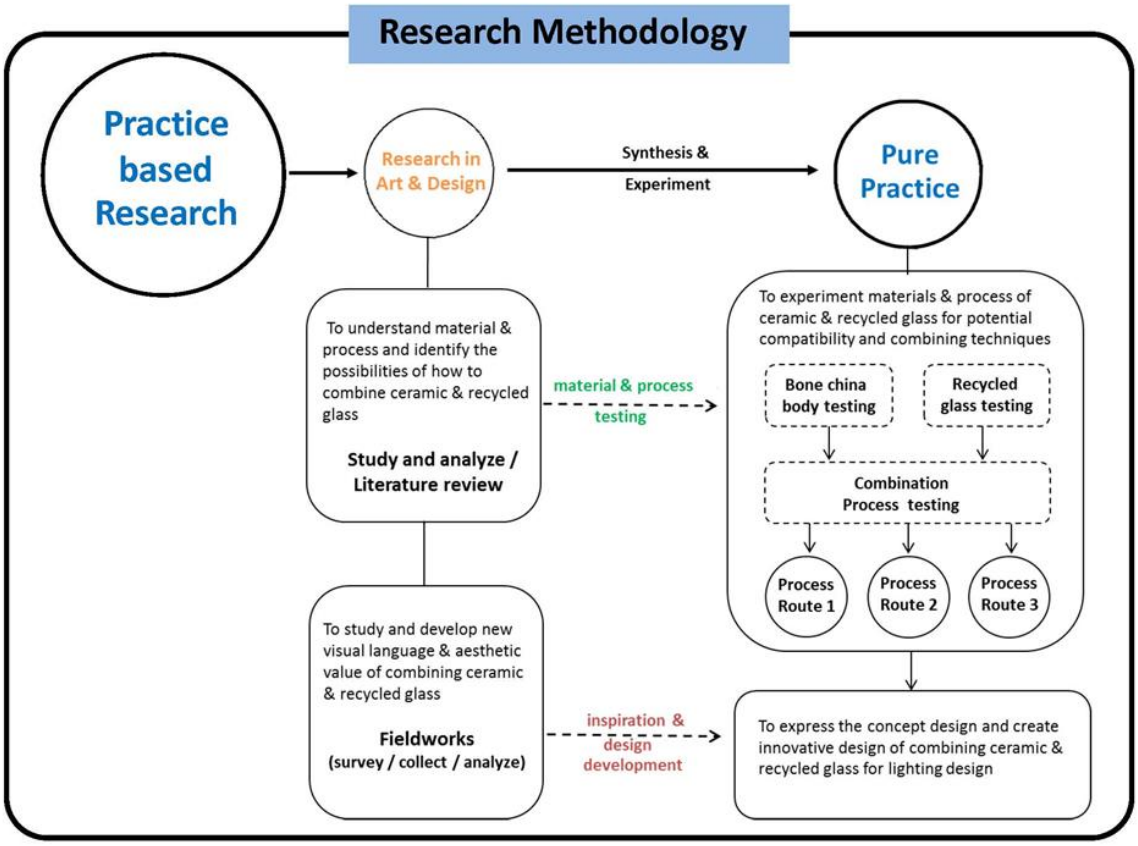

Figure1: Diagram of the research methodology.

Literature Reviews

The researcher tried to search for the artworks that combined ceramic and glass together as much as possible in the specific research timeline. The results are these 53 artworks of designers and artists worldwide which can be categorized and demonstrated into the groups as shown in the following diagram. (Fig. 2)

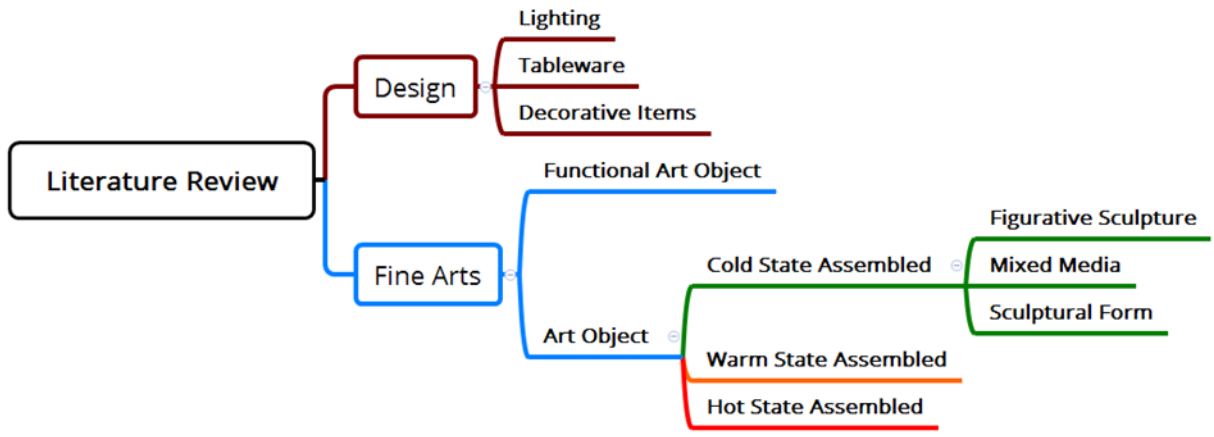

Figure 2: Diagram of the literature review

1. Design Group

1.1 Lighting

Figure 3: Diagram of Lighting

There are 6 artworks in this group. All of them emphasized on the functional use of the artwork for lighting. Therefore all of forms of the ceramic and glass elements were designed to follow the function and were produced separately and can be assembled together and are easy to use and maintain. Most of ceramic pieces were formed by the casting technique and are used as a base, while the glass elements were formed by blowing and casting and used as a light unit, except The Angel lamp where glass was used as a base and the lighting unit was made from craved bone china clay body.

1.2 Tablewares

Figure 4: Diagram of Tablewares

There are 4 artworks in this group and all of them lay emphasis on the functional use of the product. Ceramic and glass were produced separately and assembled together later. The artwork of Ivan Jelinex's cast colored glass were assembled with porcelain body by gluing together while Misa Tanaka's work ceramic and glass were assembled and fused in warm state. The Andaman table set is different in using crushed glass mixed into the glaze of the ceramic body and then fired in high temperature to create a stunning unique design of color and texture. Rebecca Harvey combined slip cast porcelain and blown glass to express contrasts in texture and density of materials to reveal unexpected harmonies when the pieces are displayed together.

1.3 Decorative items

Figure 5: Diagram of Decorative items

Most of the artworks in this group were produced separately like the lighting and tableware group but a varieties of production techniques were used to get desired result. The transformation project of Jonathan Keep and Design Unfold used 3D printing techniques to produced the ceramic work and were assembled by blowing hot glass into 3D printed clay body to experiment with a varied form, texture and color of the clay body and glass. The work of Elinor Portnoy also used 3D printing porcelain body but were combined and assembled with blown glass in cold state and can be separated and reassembled for functional use.

The artwork of Andrea Walsh using unglazed bone china as a base of the facet box were combined with kiln cast colored glass. The work of Pia Design using raku fired ceramic with blown glass and added wood work stack together to create a unique design with a variety of materials. Veronica Pöschl's work used hand built stoneware clay and blown matt glass combined and assembled in cold state.

2 Fine Arts Group

2.1 Functional Art Objects

Figure 6: Diagram of Functional Art Objects

There are 6 artworks in this group. Judi Tavil and Karen Turner's works have similarity in using hand forming clay body and fusing crushed glass on the clay surface. The results are shown in the crackle effect and the interesting contrast of clay and glass texture. The work of Nathan Anderson used the hot molten glass on the wheel thrown raku fired ceramic work created the outstanding crackle effect of glass and raku texture. Steven Branfman inlayed small colored glass pieces into the sides of wet hand thrown vessels and were fired at a high temperature. The glass melts to form a series of multi colored glassy glaze runs.

Seikishi Inamine's work used hot blown recycled glass bottle, by putting the hot glass into Machiko white clay slip and Okinawa red clay slip and then blown into desired shape. This technique created a unique crackle colored clay texture on the glass surface.

John Conrad created the distinctive artwork by using a unique process called dichroic fused porcelain: a new ceramic medium that blends traditional and historical ceramic elements and glazing with the high tech process dichroic metallic "flashing" resulting in brilliant and vibrant flashes of color.

2.2 Art Objects

2.2.1 Cold state assembled

- Figurative Sculpture

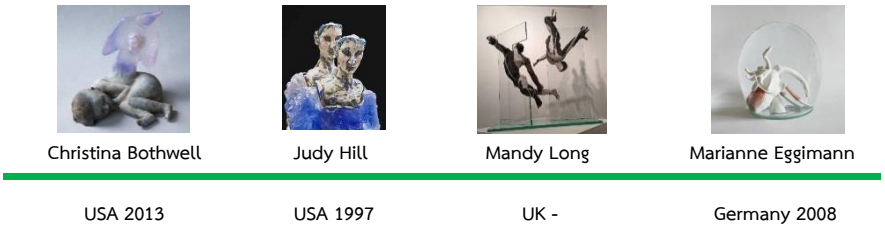

Figure 7: Diagram of Figurative Sculpture.

All of 4 artworks in this group are hand formed ceramic work. Christina Bothwell combined cast glass and raku fired ceramics to creates figurative sculptures which portray the processes of birth, death and renewal. A similar approach is that of Judy Hill, her doll-scale figures made of kiln-cast glass and raku fired ceramics. Her self-portraits are emotional studies which reveal and conceal private natures. Mandy long also use raku fired ceramic and install with cut float glass in order to render her figures air borne. Marianne Eggimann creates porcelain animals, human figurines and landscapes which are encased under a dome of blown glass. The figures are enlarged by the water giving a strange focus to the surreal scenes.

- Mixed Media

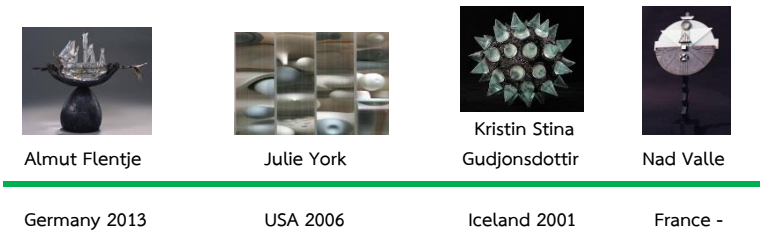

Figure 8: Diagram of Mixed Media

Almut Flentje combines raku fired ceramics, cast glass ,stone wire, lead and textiles which she combines in a cold state to express the unique arrangement of materials while Julie york mixed media sculpture reflect her visual exploration od day-to-day experiences. Found objects are reproduced in slip cast porcelain juxtaposed with metal, glass and plastic elements. Kristin Stina Gudjonsdottir create mixed media abstract sculpture in cast glass, ceramic, metal and stone, all of which were made from reused materials and found objects. Nad Valleé works in both cast glass and raku fired ceramic assembled with metal.

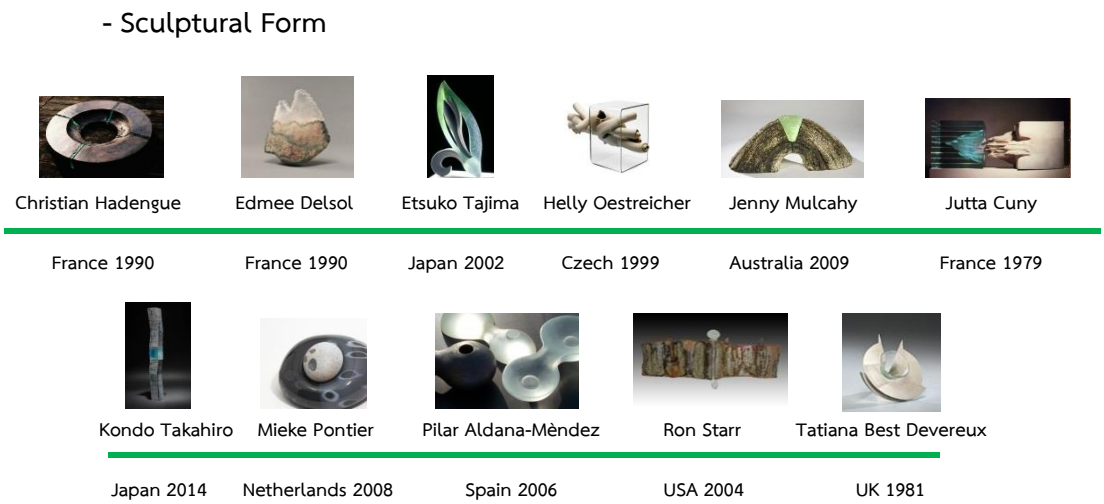

Figure 9: Diagram of Sculptural Form

Christian Hadengue, Edmeè Delsol, Etsuko Tashima, Jenny Mulcahy, Jutta Cuny and Kondo Takahiro works have similar approach by assembling ceramic and glass as one piece to express the contrasts between the transparent and opaque qualities of the materials. While Pilar Aldana-Mèndez's works are kiln cast glass juxtaposed with raku fired ceramic. Christian Hadengue creates abstract ceramic sculptures combined with sheet glass. Edmeè Delsol combines raku fired terrecotta with cast glass. Etsuko Tajima 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. Closely aligned is the work of Kondo Takahiro which his ceramics are complimented by thick blocks of glass. Ceramic glaze resemble dew, which draws links between the cast glass and ceramic surface. Jutta Cuny combines porcelain with optical crystal which were carved by using deep sandblasting techniques.

Helly Oestreicher uses extruded stoneware ceramic elements assembled with sheet glass to create her sculpture work. Tatiana Best Devereux combined kiln cast glass cores with her hand built ceramic, as similar with the work of Mieke Pontier which combined stoneware with blown glass to create her one off sculptures inspired by nature. Ron Starr uses glass as an extension of glazing on his stoneware sculptural vessels. He assembles his work aligning the contrasting qualities of the two materials in one piece.

2.2.2 Warm state assembled

Claire Phillips Thomas	Claude Bromet	Emily Barber	John Groth	Mustafa Ağatekin	Tiziana Bendall-Brunello
UK 2009	France 2004	UK 2011	USA -	Turkey -	Italy 1999

Figure 10: Diagram of Warm state assembled

Claire Phillips Thomas developed a series of works that combines slip cast ceramics, paper pulp and slumped glass. The glass melts through the pierced holes of ceramic to create runs of glass, resulting in colorful glass drips flowing through ceramic form. Claude Bromet fused colored glass into the surface of high fired ceramic setter, resulting in visible stresses and the crackle effect can be seen. Emily Barber slumps thick float glass to hand built ceramic mold as an integral part of the work, to reveal the idea of the mold being part of the final piece, not just a vehicle for its making. John Groth has developed a clay body that is compatible with the expansion rate of glass. His artwork fusing Bullseye glass with clay to create sculptural forms. Mustafa Ağatekin uses ceramic materials as an inclusion material in his glass artworks by fusing different layers together. Tiziana Bendall-Brunello uses garment 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 stress can be seen in the surface of her work.

2.2.3 Hot state assembled

Alfred Spivack	Amy Lemaire	David Binns	Felocoty Aylieff	Jessamy Kelly	Sally Resnik Rockriver	Steve Tobin
USA 2007	USA 2006	UK 2008	UK 1996	UK 2009	USA -	USA -

Figure 11: Diagram of Hot state assembled

In this group, the artworks combine ceramic and glass together at a high temperature. Alfred Spivack has developed a technique which fuses colored dichroic glass to biscuit fired thrown stoneware vessels. Slight cracks and stresses can be seen in the surface of his works. Amy Lemaire employs bead making techniques to fuse soda lime glass to her high alumina stoneware ceramic forms. David Binns adds glass to his composite mix of mineral

aggregates, which he fires into large scale sculptures. Very similar is that of Felicity Aylieff's process where she combines small pieces of glass and aggregates in her large scale ceramics and fires them at a high temperature.

A contrasting approach is that of Sally Resnik Rockriver, who generates hot state chemical reactions in her blown glass and ceramic artworks. She creates geochemical formation through high temperature crystal growth. 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 as its core. A distinct crackle effect can be seen on the surface of his works.

Dr.Jessamy Kelly developed bone china clay body that is compatible with the expansion rate of glass and fires kiln cast glass and clay together to create sculptural forms with no visible cracks. The researcher uses these artworks and her doctoral thesis "The combination of glass and ceramic as a means of artistic expression in studio practice."(University of Sunderland, 2009) as a research reference due to the characteristic of the developed bone china clay body that relates with the objectives of this research.

The implementation of combination process testing

A pure practice based process was implemented to identify potential compatibility and combining techniques. The development of these techniques were based-on a review of relevant literature of a total of 53 ceramics and glass artworks of designers and artists worldwide into three possible processing routes. Quartz added bone china clay body was identified to use due to transparency quality and compatibility with glass. The kiln-formed techniques; fusing, slumping and casting will be used to create the prototype artwork.

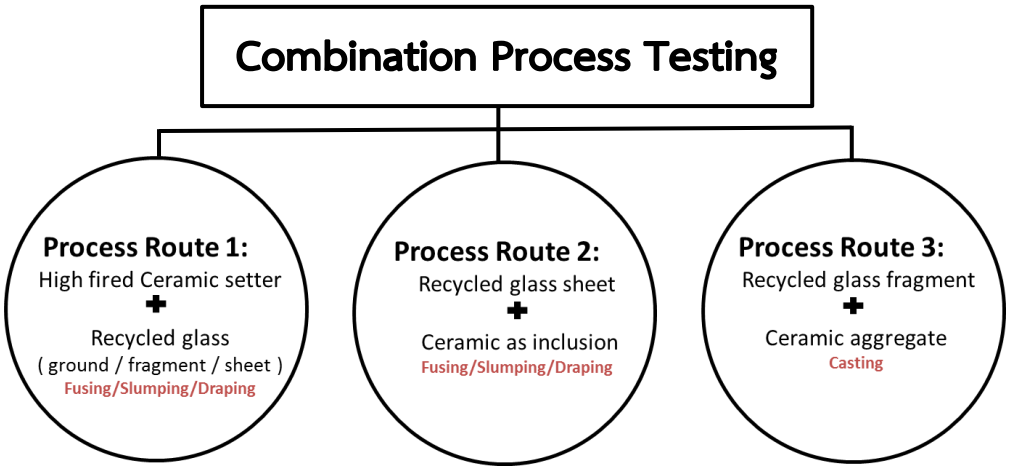

Figure 12: Diagram of Combination Process Testing

For this prototype inspiration will be drawn from “Star ceiling: patterns and elements from Thai Traditional Architecture”. The researcher was inspired by Thai traditional architecture of Benchamabopitr Temple. This temple located in Dusit palace precinct, is in honor of King Chulalongkorn, Rama V and was designed by H.R.H. Prince Narisranuvattivongse. This temple has been reckoned for its architectural and decorative arts of the finest of Thai craftsmanship. The simplification of Thais element from this temple will be used in the design to make contemporary artwork with the sense of Thainess and reflecting the artistic identity of the researcher.

Figure 13-18: Benchamabopitr Temple and Thai traditional elements from the architecture.

Process Route 1: High fired ceramic setter fusing with recycled bottle and window glass.

The researcher designs the prototype artworks by simplifying the decorative elements in the temple to a simple circular shape and uses the slab forming technique to form quartz added bone china clay bodies into desired shape, and were fired at a high temperature. The ceramic bodies were bent and deformed by the natural effect of the kiln while firing at a high temperature. Then recycled bottle and window glass were fused onto ceramic bodies.

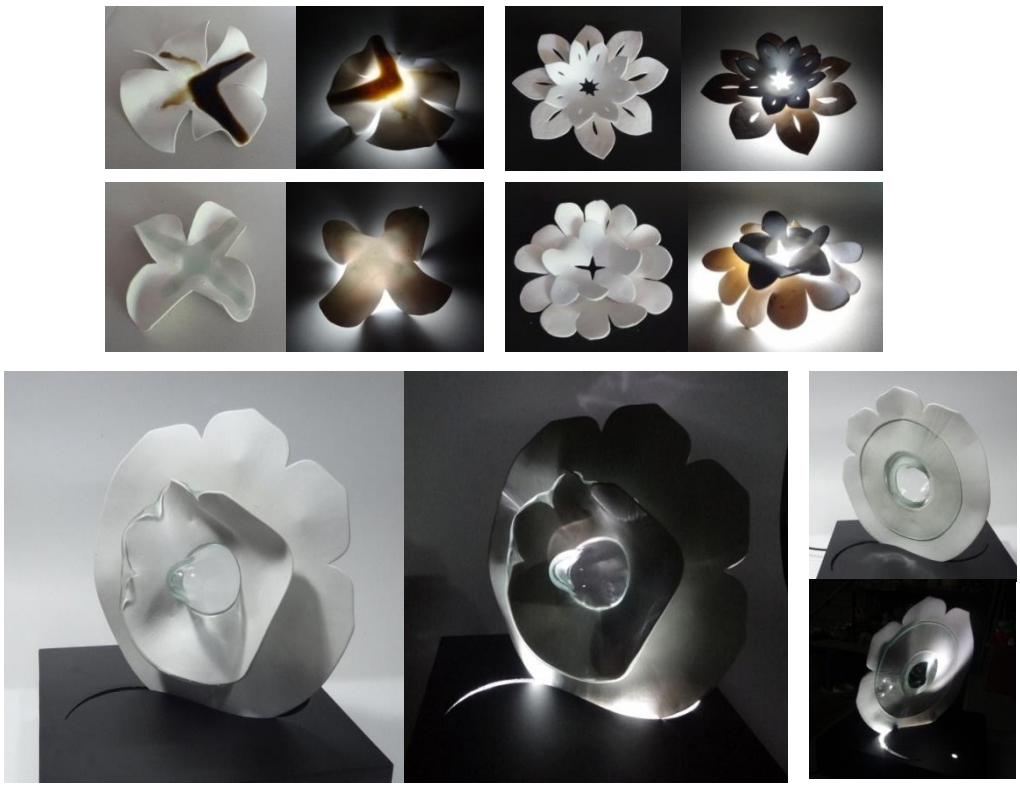

Figure 19-25: Design development of prototype artworks from process route 1

Visible cracks can be seen on the surface of the glass. After some trial and error, with the formulas of quartz percentages added to the bone china clay bodies and testing the firing cycle several times, the researcher manage to find a suitable firing cycle with compatible bone china clay bodies and recycled window glass resulting in prototype artworks with no visible cracks.

Process Route 2: Recycled window glass combine with ceramic as an inclusion

In this process, the researcher simplified the Thai elements to a simple lotus leaf shape and use the slab forming technique to form quartz added bone china clay bodies into the desired shape, and fired at a high temperature. These pieces were then arranged as an inclusion and fused with cut clear and colored window glass into patterns as seen in Fig.16. The results were not stable, some pieces had no visible cracks while some pieces did. Therefore the researcher had to adjust the firing cycle to solve these problems and developed design pattern and practical installations with light.

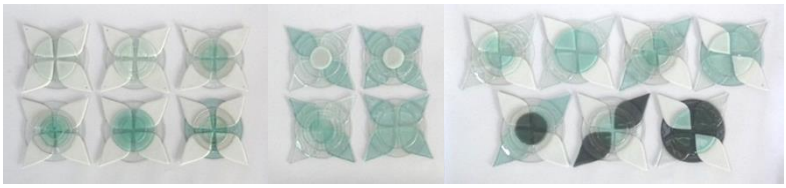

Figure 26: Design patterns with acombination of ceramics inclusion between recycled clear, green and grey colored window glass.

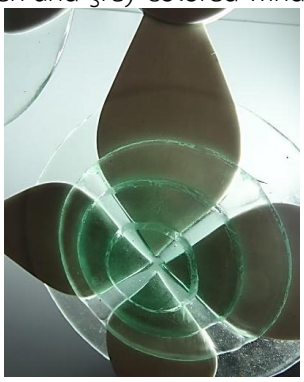

Figure 27-28:Detail of light testing and size when hung on the wall compared to the researcher standing in front.

"The designed the patterns were installed on a wall and tested with light.The results indicated that the structure of the joining point of glass and ceramic were not strong enough to be hang and would break easily."

Figure 29: Hanging installation sample.

Process Route 3: Recycled bottle and window glass fragment casting with ceramic aggregate.

This process is under the experimentation and the researcher is currently working on the firing cycle to test and identify a suitable firing technique that can cast ceramic and glass together with no visible cracks.

Conclusion

The results of the combination process of route 1 and 2 indicates that the suitable formula of quartz percentage added into bone china clay bodies were compatible with recycled glass and have no visible cracks and stresses after the firing. However the firing cycle of ceramic and glass are different, therefore the researcher has been working on the firing process by trial and error to find the appropriate cycle that is compatible with these two materials. The design and shape of ceramic works before and after firing in high temperature also play an important role in fusing, slumping and casting with glass. The researcher has intentionally designed and forming the shape of the ceramic work by the slab forming technique while setting them on carefully designedly stand points in the kiln; in order to let the ceramic pieces bend and deform by the natural effects of firing in a kiln. Ceramic pieces on firing, curve slightly due to the melting properties of bone china, and result in organic and unique forms and the researcher on purpose wishes to leverage this fascinating quality of ceramic work. The combination of ceramic and glass express the contrasts between the transparent, translucent and opaque qualities of this two materials can be beneficial for lighting design in various ways such as Light Art Installations, Decorative Lighting Design etc.

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