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Investigation of Casting Slip in Conjunction with Wire and Paper Armatures

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Abstract

The focus of this research has been to further my understanding of casting slip (liquefied clay) concerning its properties, construction methods, as well as investigations into the possibilities of the fired casting slip surfaces. The main objective of the research is to formulate a casting slip that could be used for its whiteness and thinness as well as maintain a level of strength. I began by experimenting with different formulations of casting slip. By testing combinations of different percentages of raw clay components, certain qualities can be amplified. An investigation of various papers, wire, and wax for surface development began in hopes of finding additional creative opportunities. Tea bag paper, as well as rice paper is utilized to construct armatures onto which the casting slip is applied. By brushing casting slip on the surface of the paper I am able to ascertain how much slip would crack and fall off prior to firing, which would also indicate whether the work would survive a kiln firing. Firing samples of wire at various temperatures tests the wires durability and level of heat resistance. These casting slips are based on porcelain clay bodies, which are white upon being kiln-fired. Depending on the specific ingredients in these clay bodies, it will determine the quality of white (chalk white, creamy white, etc.). A casting slip was formulated, which fired to a cool white; the surface of the clay also has a slight sheen. The tea bag paper as of yet is still the best choice for my process of construction. The nickel chromium wire withstood the highest temperatures and provided the greatest amount of support during the kiln firing. Since testing these elements, an investigation into the surface of the casting slip began.
Keywords: Ceramic, Armature, Psyche

1. Body of Paper

The world of ceramics is a diverse blend of science and the arts. Casting slip is a material that is widely used for commercial and industrial production, however it can also be employed towards art. Casting slip is liquefied, deflocculated clay. Deflocculant or electrolyte is added to the slip to isolate the clay molecules to create a smooth-flowing liquid suspension (Rhodes 1973). Electrolytes have the ability to change the electrical charge of a portion of the clay particles, this causes the particles to repel each other. These particles are now able to float freely throughout the water instead of clumping together to create a solid clay body. Deflocculant is used in minimal amounts (.3% -1.5%), if an excess of deflocculant is used it has a tendency to flocculate or create clumps to form; Darvan 7 is the preferred commercial deflocculant however sodium carbonate is also used. The amount of water is also crucial to the success of the casting

slip. Most casting slips contain between 35% and 50% water by weight. If deflocculant is not included, a greater percentage of water is necessary.

One of the main goals of this research was to formulate a casting slip, which would be used for its whiteness, and thinness while maintaining a level of strength. In every clay body there are three main components, a clay, a flux and a glasifier. The clay on its own has a composition of one part alumina two parts silica. Aluminums role in the formula is to help maintain the structure of the clay body while it is undergoing a kiln firing. Flux is a material, which raises or lowers the melting point of the clay body. Silica or quartz is used as a glasifier, it provides a hardness, and stability to the body. The whitest clay bodies are kaolins, these are found in on the site of their parent rock, they have not been transported by wind or water and therefore have remained pure (no iron contamination). The whitest kaolin currently on the market is Grolleg, this was used as the base of the mixture. Grolleg is a fine particle sized clay that is more difficult to deflocculate because there are more particles to suspend within the water. Nepheline syenite was used as the flux, because of its lower firing temperature; it melts or vitrifies more within the clay body and bonds the clay particles to a greater extent. This also provides the clay with a vitrified surface. Nepheline syenite contains sodium carbonate, which is a natural deflocculant; because of this the amount of Darvan 7 needed decreases. This formula was created to completely vitrify at cone 10 (704 ◦C), however it also functions at cone 8 (693 ◦C). All tests were completed simultaneously to decrease error of variables from temperature changes and length of kiln firings.

After formulating a white base casting slip, an investigation into including color began. Various percentages of oxides as well as inclusion stains, more commonly known as mason stains were added to the white casting slip. These samples were fired to various temperatures in an oxidation kiln. Depending on the percentage of colorant, the casting slip body had various surface qualities. For example, a 5% addition of mason stain 6650 (black) fired to cone 10 caused the body to flux to a greater extent creating a more vitrified surface. The casting slip behaved more like a glaze and less like a clay body. The increased flux created a greater bond between the particle while allowing the object to melt and warp out of place. This resulted in a mutated object with an attractive surface.

Because of the liquefied, viscous nature of the slip, it is commonly poured into plaster molds, however it can also be sprayed or painted onto a surface. By painting the slip onto a paper armature the slip has an underlying structure to cling to. Not all papers can be implemented successfully with this method of construction. An investigation into commercially available papers resulted in the discovery of key characteristics for the success of proper bonding between paper and casting slip. Papers that are more fibrous are found to have greater success. Other variables such as the amount of fibers per inch as well as type of fibers are significant. In terms of store bought papers, the tea bag paper has had the greatest amount of success while using this method of construction. The use of rice paper has also been successful when making less complicated objects. Rice paper is found to be less absorbent of casting slip, which makes the slip more likely to flake off before being kiln fired. It also found that the rice paper does not burn out completely, leaving behind a white crusty residue on the fired clay. For the greatest amount of bonding between the unfired casting slip and paper, a hand made paper provides the greatest amount of control over the advantageous variables.

In order to create three-dimensional objects a wire armature must be utilized. An armature is an underlying structure that provides support. Armatures can be used primarily during construction of an object, or it may be incorporated into the final piece. For my cozen method of construction it is found that incorporating an internal wire structure within the paper object allows for the greatest amount of success. From this general realization, an investigation of various wires began. Because of the different types of metal used results varied, mostly depending on the temperature the object was fired to. Due to the high temperature the clay was designed to fire to, it was important to find a wire that could hold its form and provide support at temperatures up to cone 10. Various gages as well as metals were tested at different temperatures. At cone 10, copper will burn out leaving a trail of residue, it also has the tendency of running down the surface of the object. Steel wire doesn't burn out completely, it has a tendency of migrating out of the paper while bubbling and blistering; the remaining wire is very brittle. Brass wire provides a sufficient amount of support however, it leaves scorch marks where it was imbedded into the paper. If brass is placed on the surface of an object it burns out completely while eating through the ceramic material. Nickel chromium was the only wire tested which maintained its integrity through a cone 10 kiln firing. It is also found that nickel chromium migrates out of paper objects, which decreases the survival rate of the fired object.

Once all of the results were compiled, it was possible to apply the information gained. This research into a particular method of construction was significant in expressing my creative ideas. Conceptually, I am interested in the human psyche. Observing everyday behaviors and interactions fuels my creative process. By interpreting these subtleties in behavior I strive to interject these traits onto these ceramic forms. This method of construction conveys an overwhelming sense of fragility, and impermanence. It is important for the object to survive its initial conception but it is not important that these pieces are archival. This is intended to convey the tenuous reality we occupy. An interest in the individual is shown however, these individual pieces are very rarely shown singularly. Because existence isn't exclusively based upon our own reality, but a compilation of the collective conscious, multiples are implemented.

The conception of these objects are achieved threw baptism by fire. The cone 10 fireing is a traumatic experience as temperatures exceed that of an object re-entering earths atmosphere. Once the kiln has cooled the objects are frozen in time, unable to adapt to their surroundings. When placed on an unyielding surface, the objects chip and shatter in a self-destructing act. Every object has its own life span, when their complete destruction occurs is unknown. The only certainty is that not one will exist unaltered external circumstances.

2. Ceramic Works

***Stitched,* Casting slip, Paper, Brass, Thread, 2009**

Tea bowls, **Casting slip, Brass, 2009**

***Trio,* Casting slip, Copper wire, 2009**

***Untitled*, Paper, Thread, 2009**

***T109*, Casting slip, 2009**

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4. References

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2. Interview with Charlie Olson Ceramics Professor at UW-Whitewater, November 20, 2009.