Abstract-Glaze Testing: Methods and Results

by

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Floating blue is a glaze that appears to have a blue layer floating over an earthy undertone, giving it the illusion of depth. The base of the glaze floating blue was taken aside while its original colorants (rutile, red iron oxide, and cobalt carbonate) were added in different increments with other ones to get different hues. The main goal was to produce a green version of floating blue, that is, a glaze that has the same textural and visual effect as floating blue that instead has a green hue. This was tested by replacing cobalt carbonate with copper carbonate, while adding different amounts of the other two colorants, red iron oxide and rutile. The base of floating blue was taken and separated into groups, and the decision of what percentages of other colorants to add was made by using a triaxial blend method of charting out and keeping track of different colorants. These test glazes were then applied to test tiles made out of stoneware. The results did not meet the expectation, but did show that the goal might have been met if a higher percentage of red iron oxide and rutile had been used, and if I had a richer green colorant to work with. Further testing would be required to meet this goal, and my timeframe made this impossible for the time being.

Research

Potters are artists, craftsmen, skilled in working with their hands. They also must be chemists. That’s a strange thought at first, but it makes sense once glazes are more closely
observed. Glaze is defined in *The Potter’s Dictionary of Materials and Techniques 5th edition* by Frank and Janet Hamer as, “a layer of glass which is fused into place on a pottery body.” The book explains that this glass is initially applied in the form of powder, which is made up of fluxes, stabilizers, and glass-forming materials.

Because the materials are mixed in different proportions and different combinations with the addition of different colorant, they come in all kinds of different textures and colors. In order to predict surface textures and colors, one must have at least some knowledge of basic chemistry. My goal is to use this basic understanding of chemistry to create a green version of Floating Blue.

Floating Blue is a cone six glossy glaze, and is extremely popular due to its depth. There appears to be a blue cascading layer floating over a dark, earthy undertone. This is clearer when applied to a textured surface, allowing the glaze to break and reveal the undertone.

The desire is to see this beautiful glaze with all of these desirable effects, but with a green hue rather than blue. The desired effects are the cascading floating layer look, the earthy break over texture, and the richness of the main color. The earthy color is mainly caused by the colorant red iron oxide. The cascading effect added to the main color is caused by rutile. These two colorants will therefore be included in testing. The colorant to be replaced is cobalt carbonate, and its replacement is copper carbonate, a typical green colorant. The triaxial blend method will be used to determine the amount of each colorant to accomplish the goal. “*Clay: A Studio Handbook*”, by Vince Pitelka describes the triaxial blend method as follows: “Method for testing three-way combinations of glaze materials, where proportional amounts vary through a series of samples between three limits.”
To begin the research process, I first created test tiles out of clay to be fired and glazed with the different test glazes. These tiles were made using clay slabs, made as consistent in thickness as possible. This is important because different thickness in clay can affect how well glaze fuses to clay. To allow the results to be consistent for each different glaze tested on them, all of the tiles have to be a proper thickness.

After making the slabs I made bases for the tiles, then I cut pieces to be attached vertically on the bases so that each tile is standing upright. This is so that we can see how well the glaze fuses to the clay, if it drips, or how it will crystallize on most ceramic pieces. Glazes crystallize differently on vertical pieces than on horizontal pieces due to the way gravity affects it while it’s in its liquid state during firing.

I carved some vertical and horizontal niches into one side of each tile to see how the glazes react to texture. If the glaze behaves how I hope, which is like Floating Blue, the deep color will get into the crevices while a brown undertone is revealed over the edges and corners. This part of the experiment is important, because that reaction to texture may be the most desirable characteristic offered by Floating Blue.

After creating and firing these tiles, I mixed the base glaze for Floating Blue. The base of a glaze is a recipe for simple glass, and they come in different variation for different textural effects. Glazes get their color when small amounts of carbonates and oxides of some metals are, and we call these colorants.

I wrote out a diagram for the triaxial blend method, wherein I spread fifteen slots in a pyramid formation. This is where I decided what amount of colorants to add to 100 gram units of the base of the glaze. At the top corner of the pyramid, the only colorant added was copper carbonate. This colorant was chosen because it’s a green colorant. In the left corner the colorant
used is rutile, which adds a yellowish effect and also gives the colored layer of floating blue the cascading look it has. The other corner had the red iron oxide, which adds the earthy undertone.

The above diagram shows the exact weight in grams of each colorant used per one-hundred gram unit of the base, and the formation of shifts in amount to clarify reasons for the choices of each used. Starting with copper carbonate, as it moves down the chart further and further away from its corner, the number grows until it gets to the last row. The same applies to the other two corners. The reason it grows is so that the scale of colorant added remains balanced across the chart. The reason it stops at the last row, however, is to see the results of the isolated combination of only two colorants at a time.

With all of the test glazes in labeled cups, seventy-five grams of water were added to each one-hundred gram cup of the powder. After a while the water permeated all the powder and
it was time to mix one cup at a time to dip a tile in, hold for two seconds, and take it out. When all of them were done, it was time to fire them and get the results.

Conclusions and Inferences

After firing the test tiles, I observed that all of the test glazes were much more translucent than anticipated and lacked the same depth Floating Blue has. There was no earthy undertone and certainly no cascading, and the green was present but was not very rich. It was instead more of a forest looking green. One tile, one alone began to exhibit some semblance of depth, and there was even some cascading inside one of the crevices of the tile. But the cascading part
turned out blue. This was exhibited one the tile with two grams of copper carbonate, three quarters of a gram of red iron oxide, and three grams of rutile. All of them weren’t entirely disappointing, as they were still quite pretty. They just didn’t meet the expectations I had for them.

The conclusion that brings me to is that there was neither enough of any of the colorants added. The combination of colorants that exhibited the results closest to the goal had the most colorants in total than any of the others tested. In further testing, I would add a significantly larger amount of rutile and red iron oxide, and would probably try another green colorant, chromium oxide, in combination with copper carbonate as well as independently.

Due to my timeframe, I was unable to continue exploring and testing these ideas after the data was gathered. I do hope to continue with this in my future.