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## Chasing the Craze: When the Right Variables are Off-Stage

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# Chasing the Craze: When the Right Variables are Off-Stage

## **Abstract**

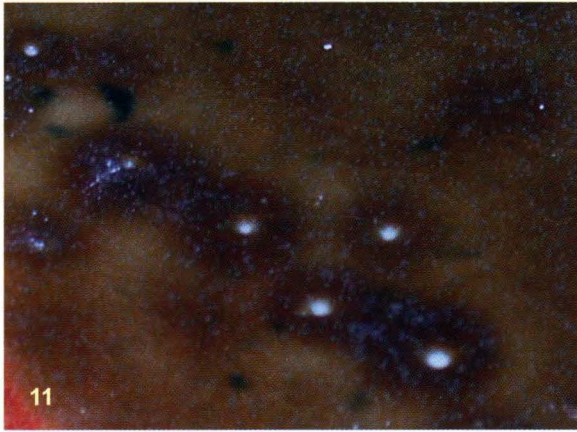
A smooth white glaze, (Figure 1) with a buttery surface and smooth breaking on edges, just enough change of whiteness in a crevice pooling, seemingly opaque when thicker, but with a certain glow, a slight grey showing through. It crazes slightly, a fine webbing of cracks. Not enough to be decorative crazing, and not enough crazing to make me abandon the glaze, but enough crazing that I would like it to be gone. I prefer a system-oriented testing approach as a kind of universal order. A simple Unity Molecular Formula grid mapping method typically shows a boundary line of crazed and non-crazed surfaces and trends in surface quality. Sounds simple enough. But, as has been said, there is no need to seek the ceramic troubles. They will find you. (*excerpt*)

## **Keywords**

glaze, ceramic glaze, ceramics, unity formula mapping, unity molecular formula, universal glazing theory

## **Disciplines**

Art and Design | Ceramic Arts



The best method for finding a substitute clay is to first determine what group the original clay falls within. Clays are divided into the following classifications: fireclays, stoneware clays, ball clays, kaolins, earthenware clays, and bentonites. Once you have determined what group your clay falls within, choose a replacement from the same group, then fine tune the search regarding its fired color and plasticity. Note that there are variations within each group as some kaolins are more plastic than others and some stoneware clays can fire darker than others. For example, Grolleg, a plastic kaolin, can be substituted for E.P.K., another white firing plastic kaolin. Conversely, a less suitable choice would be using Goldart stoneware clay, which has a lower iron content than Newman Red stoneware clay. Obtaining a chemical analysis sheet on the clays or asking your ceramics supplier can further guide your substitution choice.

### General Guidelines for Glazes

Commercial or potter developed glazes are composed of processed and/or raw materials. When developing glazes, always order the whole original processors bag as opposed to just getting a 5 lb. bag of white powder, which might not be what you ordered. Ask for a chemical analysis sheet, which will state the particle size of the material and reorder from the same processor and the same particle size. This will insure a consistent glaze result. Most raw materials used in the base glaze (excluding coloring oxides, additives, or stains) such as flint, feldspar, talc, dolomite, kaolin, etc. are less expensive per/pound when ordering the whole bag. However, due to their expense, materials such as cobalt oxide, cobalt carbonate, stains, and tin can be purchased in small amounts.

Whether using commercial glazes or your own formulas, the most frequent defects occur when applying the glaze too thin or thick. Thin glaze applications can cause a lack of glaze color or reveal the underlying clay body color. Thin applications can also have a rough surface due to an insufficient layer of glaze. Excessively thick applications can cause a glaze to run down vertical surfaces or pool in recessed horizontal areas. In extreme instances, a thick glaze can cause sharp-edge cracking in thin walled forms due to clay body and glazes incompatible rates of contraction upon cooling. Most glazes will work well if applied to the thickness of three or four business cards stacked together.

### Cracks

Two types of cracks can occur in glazed functional pottery or sculpture that will help the potter decide the possible cause of the problem and its eventual correction.

Sharp-edged cracks in the fired glaze (the crack looks like you hit it with a hammer)—these are cooling cracks that occurred after the glaze had hardened at some point in the cooling cycle.

Round-edged cracks in the fired glaze (the fired glaze rolls back from the crack)—these types of cracks occur either in the forming, drying, or bisque firing stages and then the glaze is applied over the existing crack.

At some point potters will have to diagnose and solve a defect caused by kilns, clays, or glazes. Be prepared with a little knowledge, which can prevent a lot of frustration.

## Chasing the Craze: When the Right Variables are Off-Stage Tina Gebhart

### In Pursuit Of The Future:

*“Removing Flaws, Maintaining Interest:  
Ceramic Glaze Improvement Methodology  
via Unity Formula Mapping*

### The Quest:

A smooth white glaze, (Figure 1) with a buttery surface and smooth breaking on edges, just enough change of whiteness in a crevice pooling, seemingly opaque when thicker, but with a certain glow, a slight grey showing through. It crazes slightly, a fine webbing of cracks. Not enough to be decorative crazing, and not enough crazing to make me abandon the glaze, but enough crazing that I would like it to be gone.

I prefer a system-oriented testing approach as a kind of universal order. A simple Unity Molecular Formula grid mapping method typically shows a boundary line of crazed and non-crazed surfaces and trends in surface quality. Sounds simple enough. But, as has been said, there is no need to seek the ceramic troubles. They will find you.

### Glaze Theory & Approach:

This series of tests hoped to become the foundation of a larger flaw improvement system. A “Universal Glazing Theory” of sorts, in initially focusing on a single glaze recipe that is a work in progress. I share with you an inquiry process that combining discovery tactics with a systematic testing approach.

These glaze tests aim to remove crazing (fine webbing of cracks in the glaze) from the Smooth Satin Matte glaze I use,

Smooth Satin Matte	C/10 reduction
Gillespie Borate	12
Custer feldspar	41
EPK	5
Talc	15
Dolomite	7
Silica	20

using a unity formula grid surrounding the original recipe (at center of grid). The grid samples are in unity formula increments of 0.5 SiO<sub>2</sub> across the X axis and increments of 0.05 Al<sub>2</sub>O<sub>3</sub> up the Y axis.

#### Unity Molecular Formula

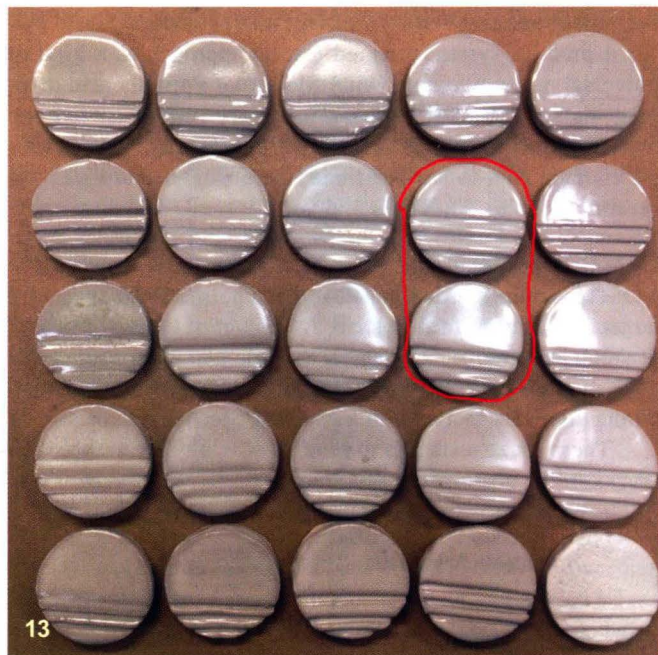
• KNa <sub>2</sub> O:	0.21	• SiO <sub>2</sub> :	2.984
• total glass former (SiO <sub>2</sub> + B <sub>2</sub> O <sub>3</sub> ):	3.11		
• CaO:	0.325	• Alumina :	0.266
• MgO:	0.461		

Fashioned after the Stull & Howat<sup>1</sup> glaze testing a century ago, the trends of other flux combinations using this same approach were examined by Brian Quinlan<sup>2</sup> in his research with Dr. William Carty at Alfred University. The resulting maps show changes in crazing and surface quality (gloss-satin-matte). These UMF series showed a distinct boundary line between crazed and not crazed glaze increment samples, among other trends. Others have been inspired by this testing foundational approach where with a given flux combination, increments of increasing silica and alumina are tested (molar).

Essentially, we used this mapping approach but with the specific flux combination of the Smooth Satin Matte glaze, fitting the grid to the glaze, rather than using the theoretical flux groupings found in Quinlan's or Stull's work.

More simply, using unity increments, we slowly and theoretically stepped away from that original recipe in search of the boundary line between crazed and not crazed. Broadly put, we were moving away from the original flaws, in search of where that flaw would disappear hoping that the preferred glaze qualities remain.

In the end, the ideal recipe for Smooth Satin Matte may be found around the red-circled region, shown below, as with



**Material Doctors, Gebhart: 13 "SM-2C" puck grid.** Two glaze dips, fired cold at c/10 half (c/10 down by unloading time); 2014, Photo by Meagan Lupolt, Research Assistant. **14** Glaze Sample, grid of mini pots: "T2" with Interface Cracking, 2014, detail; Photo by Meagan Lupolt, Research Assistant. **15** Glaze Sample, small pot: "T2" with Interface Cracking, 2014, detail; Photo by Tina Gebhart. **16** Tina Gebhart: *Pumpkinned Ewer* 8x7x5" Porcelain, 2014. **17** Tina Gebhart: *Hip Hugger Mug* 6x5x4" Porcelain, 2014. Photos 16 & 17: Tina Gebhart

initial eye-based observation, it appeared that the crazing was alleviated in the step to the right of the original sample. In at least one of the preliminary puck grids, the crazing was visually alleviated in a region, and in later grids, crazing was visually eliminated in large regions.

#### Testing Process:

We used test pucks designed to be simple yet show certain form details that I use in my pots. The round, flat tiles with applied grooves show both breaking and pooling of glaze and were produced mostly by research assistant Madison Seneney.

After the first test firing, we found that on the flat puck surfaces, the crazing did not reliably occur (or it did not as obviously occur). It was more pronounced (or was more noticeable) on the real curves of pots with the original glaze. We designed a small cup with a cut foot and in the spirit of my pots for two ends – to see if there was a different effect on crazing between the flat and curved surfaces, and to begin to see the aesthetic of the glaze in-situ for broader quality judgments. There was a crazing difference between these, though it may be an indirect cause.

My research assistant Meagan Lupolt produced these miniature pots as dual technical training, and did so with excellent finesse and with increasingly skillful speed.



Based on what we observed subjectively in the fired glaze, we tested variables of single and double-dips of the glaze, as well as colder vs. hotter firings (c/10 halfway vs. c/11 halfway). The 2-dips-colder series appeared aesthetically the most like the original glaze's results on studio pots.

The glaze samples were batched using a volume blending approach<sup>3</sup>, built for faster batching of a larger sample grid, allowing us to see trends across more samples for planning purposes. A small grid approach would

be best for developing a broader testing system. These tests initially suggested that small singular testing steps (a smaller grid of 9 samples) could work as a generally applied testing approach, and a second set of tests could follow as needed.

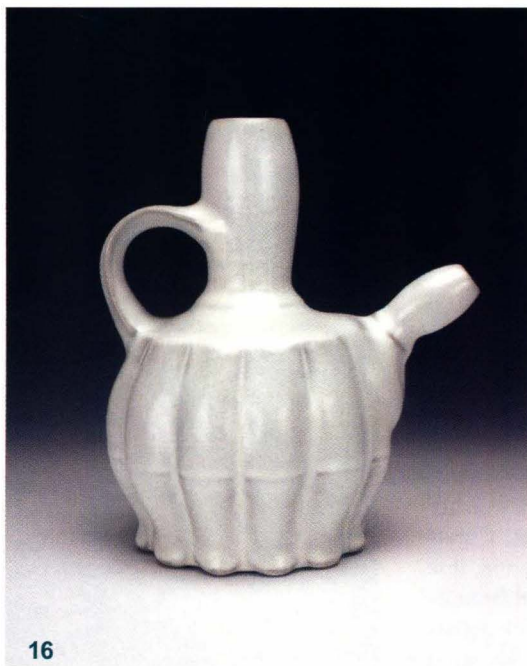
We also tested a second glaze "T2", which had a more difficult flaw, crazing-cracking into the clay body, often causing the pot to crack apart. The glaze had a fabulous speckled appearance when thinner and a surface reflection hares fur effect when thicker, but was structurally unsound. This glaze requires several more testing cycles, as it remains severely flawed in the first test series. So far all samples that have similar good qualities...still have some amount of the cracking problem. We will consider incremental adjustments to address the interface strain in the longer-range future.

#### Future work:

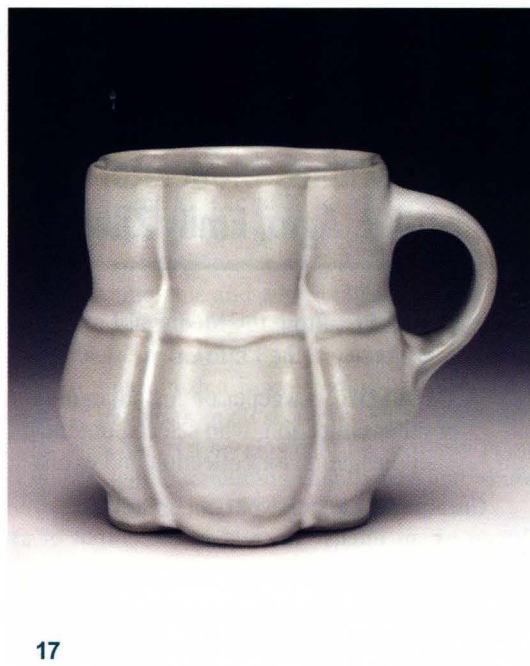
There are many options for future work, as the most substantial new understanding here is that although we expected and pursued a chemistry solution to this fairly basic flaw in the Smooth Satin Matte glaze, and although it is still a standard thermal expansion coefficient mismatch (as is the fundamental nature of crazing)...the variables that seem to be contributing the most to the flaw involve basic, mechanical things. Some of the variables were noticed and clarified by a simple tactic -- used to see the crazing more vividly in a photo.

Very low tech variables that will be included in the conference presentation, along with my new understanding that the "mundane solutions" may be profound. (Thickness, temperature, and the substrate's interface, i.e. what clay it is on.)

Additional tests are needed or could be used, potentially of larger volumes for dipping onto fuller pots to begin judging the glaze in a more real-use context so that the broader look of the glaze might be best judged and retained. We could potentially test lag time increments to determine if slight settling of the glaze materials influenced results. (Although poor mixing is a common studio ceramics problem, it is more often an issue when the glaze recipe is near to a crazing boundary line on the grid, as then the glaze does not need to settle far in order for



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there to be an effect. It is worth testing none-the-less.)

That simple tactic may lead us to quantifying the crazing on the samples, to map not just the region in which there is or is not crazing, but how much and how tight the crazing lines are. We could also use this to potentially determine whether this crazing continues to develop over time.

1 Stull, R. T. and Howat W. L., "Deformation Temperatures of Some Porcelain Glazes"; pp 454-460, *Transactions of the American Ceramic Society, XIV*. The American Ceramic Society, Columbus, Ohio, 1912.

2 Quinlan, B., *The Unity Molecular Formula Approach to Glaze Development*, M.S. Thesis, Alfred University, Alfred, New York, Feb. 2002.

3 Currie, Ian, *Revealing Glazes using the Grid Method*, Published by Bootstrap Press. 2000.

**Tina Gebhart** is a *Ceramic's Monthly* "TechnoFile" contributor and a two-time finalist for the Zanesville Prize in Ceramics. She is known for her porcelain teapots and ensembles of concept-function. An assistant professor at Gettysburg College, PA, she earned her MFA from Alfred University, BFA from Penn State, and was a fellowship resident at Baltimore Clayworks.

**Jonathan Kaplan** earned a BFA from Rhode Island School of Design and an MFA from Southern Illinois University at Edwardsville. He has had a serendipitous career teaching and writing, and has had an active studio practice for over 40 years. He now curates Plinth Gallery and serves on the board of *The Studio Potter*.

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