

SPECIAL SECTION OF THE OREGON POTTERS' ASSOCIATION NEWSLETTER  
AUGUST 2010: RED

CHROME-TIN RED

*Submitted by Chic Lotz:* The FLUX in the base glaze will determine what color of glaze the coloring oxide will produce. (Chic Lotz submitted information about different types of red glazes that are included in several parts of this Special Section)

*Chrome-Tin Red for Electric Kilns, submitted by Chic Lotz:* To create a chrome-tin red glaze, you need to start with a high calcium (CaO) base glaze. That means a glaze with lots of whiting or wollastonite. Most of them will include some boron oxide from Gerstley Borate or a boron frit, which also add more calcium to the glaze. Using soda in the glaze will make a brighter red so choose a soda feldspar or Nepheline Syenite for the glaze core if you like that. Without a high calcium glaze base, raising the chrome and tin will make a green or gray glaze. If you add a tad of cobalt to a glossy red glaze, you will get glossy purple. Do a line blend raising the cobalt in small increments to get the shade of purple that you like.

*Glossy Red Rose ^6 Electric*

16 Nepheline Syenite  
20 Gerstley Borate  
32 Silica  
20 Whiting  
11 Kaolin

*Add:*

0.2 Chromium Oxide  
5.0 Tin oxide

*Unity Molecular Formula:*

.112 Na2O    .292 Al2O3    2.707 SiO2  
.026 K2O    .246 B2O3  
.006 MgO  
.856 CaO

*Chrome-Tin Reds, from Janet Buskirk's files:* I have found a few formulas in my files for cone 6 chrome red glazes:

*Chrome Red* from Frederick Pottery School, *Clay Times* magazine, Sept/Oct 2006, cone 6. Sieve twice through 80 mesh screen:

Soda feldspar 43  
Gerstley borate 20  
Whiting 20  
Silica (325 mesh) 12  
EPK 5  
Add: Tin oxide 7.5  
Chrome oxide 0.85

*Red Purple/Burgundy*, various versions of this are in my files, sometimes it is attributed to Richard Burkett. Cone 6-7, one version is in the March-April 2005 *Clay Times*. The chrome and cobalt vary, depending on the source:

Nepheline syenite 16  
Gerstley borate 21  
EPK 11  
Whiting 20  
Silica 32  
Add: Tin oxide 5  
Chrome oxide 0.14-0.15  
Cobalt carb 0-0.25

IRON RED

*Iron Red aka Tomato Red, submitted by Chic Lotz:* An iron red base glaze must contain some magnesium (MgO) which is found in dolomite and talc. The glaze must also contain some phosphorus pentoxide (P2O5) which we get from bone ash. And lots of red iron oxide. A slow cool can also enhance the red color.

*Red Rust ^6 Electric*

20 Soda Feldspar -Kone F4

30 Silica  
31 Gerstley Borate  
14 Talc  
5 Kaolin

Add:

15 Red Iron Oxide

*Unity Molecular Formula:*

.132 Na<sub>2</sub>O .278 Al<sub>2</sub>O<sub>3</sub> 3.512 SiO<sub>2</sub>

.037 K<sub>2</sub>O .403 B<sub>2</sub>O<sub>3</sub>

.367 MgO

.464 CaO

*Submitted by Roxanne Hunnicutt:* This following recipe for a red glaze was really being quite difficult to get anything decent with until used with the firing schedule below. Then it is just fantastic.

*Red Orange Glaze – Cone 6 Oxidation*

Kona F4 46.7

EPK 40

Bentonite 2

Bone Ash 15

Lithium 4

Talc 16.9

Flint 11.4

(total 100)

Add: crocus martis 11.5

(This may have come from Clay Times but it makes the glaze above, sometimes called "Orange Red," just pop):

Ramp 1: 450 deg/hour up to Cone 6

Ramp 2: Cool at 600 deg/hour down to 1800 deg.

Ramp 3: Cool at 150 deg/hour down to 1300 deg.

You can crash cool from here.

*Ketchup Red cone 6 oxidation, from an article about Jayne Shatz in the Sept 2005 Ceramics Monthly:*

Custer feldspar 20

Gerstley borate 31

talc 14

EPK 5

Silica 30

Add: Spanish Red Iron Oxide 15

*Tomato Reds at Cone 6* is an article by Pete Pinnell in the May-June 2009 *Clay Times*. If you are working on reds at this temperature, get your hands on a copy of this article. It discusses firing & cooling schedules, types of iron to use, varying silica and alumina amount, as well as adding other ingredients.

## COPPER RED

*Copper Reds – Reduction, submitted by Chic Lotz:* Copper reds in reduction are very sensitive to the kiln atmosphere and temperature. The base glaze should be a high alkaline glaze which means it needs lots of soda (Na<sub>2</sub>O), potash (K<sub>2</sub>O) or lithium (Li<sub>2</sub>O) which are found in feldspars. The high alkaline content makes it runny, prone to craze and to settle in the bottom of the bucket (add 2% bentonite to help keep it in suspension).

Copper reds also include some boric oxide (B<sub>2</sub>O<sub>3</sub>) either from gerstley borate or a boron frit. Copper carbonate is the main colorant used along with tin oxide in a ratio of at least 3:1 copper to tin. Additions of small amounts of cobalt can turn it more towards purple as will small additions of rutile + titanium dioxide. Some copper reds will be low in alumina and/or silica would make them unstable for food surfaces. A glaze that is low in silica and/or alumina and is high alkaline produces a "soft" glaze surface that can be affected by dishwasher soaps and can leach metals into foods. So be sure your copper red is food safe before mass producing lots of dinnerware.

*I'm writing about REDS, Submitted by Don Clarke:* Perhaps you've noticed (like others) that I have a lot of reds in my booth. People often come up to me and say "oh, you're the potter that does the reds" so I guess I'm kind'a obligated to say something about reds ... so here goes.

I find reds are extremely easy to achieve ... I have been using a standard recipe (see below) called Cranberry that I got years ago from a fellow potter at Club Mud. I use all my reds on Laguna B-Mix simply because (besides being an amazing throwing clay) it provides such a clean canvas/background for the reds. I dip my smaller pieces, but I spray my larger pieces simply because my glaze batches (8000g) aren't big enough to get large pieces into the bucket to dip.

Years ago I read a short section on reduction firing copper reds in an old, dusty book I found at Club Mud. Since I was new to reds, I simply followed the instructions and viola I have been getting reds ever since. The basics of the advise were to (1) fire a neutral kiln up to cone-010 then (2) go into a strong – but not smoky – body reduction for about 35 minutes then (3) continue the firing with very slight reduction up until cone-9 is down and cone-10 is starting over then (4) put the kiln back into reduction for about 10 minutes followed by a short 5 minute clean-out and call it done. I always button up the kiln (burner ports and damper) for at least a full day before even considering cracking it to start cooling.

Now, perhaps that's all to easy or perhaps its just plain confusing ... not sure, but to me it has become SOP (standard operating practice) and work 95% of the time.

That 5% that is not right is usually user error ... tips that I have been told (and believe) over the years include (1) not firing too hot – I always stop before cone 10 is flat and (2) trying not to get too much direct flame impingement (as in hanging something over the edge of the shelf so that the flame coming up the wall is actually hitting the pot). Both of these events can cause the copper to volatilize off and you get a lovely white piece (which isn't bad since it glaze tends to crack and you can rub india ink into the cracks and get lovely pieces!).

So ... that's about all I can say about reds ...

*Cranberry Red: 9-10 Reduction. Ingredients are percent by weight*

Custer feldspar 73.80

Gerstley borate 10.20

Whiting 11.10

Flint 4.90

(total: 100.00)

*add:*

Copper carbonate 0.35

Tin oxide 1.00

*Copper Red, Submitted by Janet Buskirk:* I have fired copper reds in cone 10 reduction for many years. While the firing technique for copper reds is quite important, I have found the cooling technique to be at least as important. I currently use an oxy-probe, although for many years I fired without one with equally good results.

Most of my glazes contain about 0.3% copper carbonate, a couple of percent tin oxide plus some rutile to make them a bit more purple-red. One formula is below.

I fire the kiln with a neutral flame to cone 010, then I go into body reduction. My body reduction has a strong flame out of both peepholes, but no actual black smoke coming out of the kiln. This is about .74 on the oxy-probe. After 30 minutes of body reduction, I fire the kiln in light reduction until cone 10 is soft. My light reduction has a strong flame out the top peephole and a wispy flame out the bottom peep hole, it is about .64 on the oxy-probe. At cone 10, I reduce more heavily for 30 minutes. During this reduction, I have a strong flame out both peepholes, but again no sooty smoke out of the kiln. This is about .7 on the oxy-probe.

Cooling is just as important as the firing. I have two cooling cycles. One is my "normal cooling," where I simply close the kiln up and walk away. The other is "crash cooling," which I will describe below. For My copper glazes with a bit of rutile, the normal cooling produces strong blues. The crash cooling produces bright reds. Of course, a tightly packed kiln cools slower than a loosely packed kiln, and the top and bottom of the kiln cool at different rate. These affect the colors as well. I always test all of my glazes in a tightly packed, normally cooled kiln as well as in a loosely packed, crash cooled kiln. All glazes have dramatic differences in these two situations.

My crash cooling is fairly simple. When I turn off the kiln, I open the damper and all peep holes. I monitor the kiln, and when the bottom peephole color appears to be at about cone 04, I close the bottom peephole and close the damper halfway (this takes about an hour in the summer, half hour in the winter). When the top peephole color is about cone 04, I close the top peephole (an hour or two later). In the summer, I leave the damper half way open during the entire cooling. In the winter, I close it when I close the top peephole.

*Janet's Copper Opal #7, cone 10 reduction*

Custer Feldspar 31.9

Silica 31.9

Whiting 9.7

Dolomite 6.6

Gerstley Borate\* 3.3

EPK 3.8

Frit 3124 9.4  
Lithium Carb 3.3  
Tin Oxide 2.0  
Copper Carb 0.3  
Bentonite 1.3

\*I use 50/50 Gerstley Borate and Laguna Borate

*Copper Red in Electric Kilns:* The July/August issue of *Ceramic Review* had a nice article by Mike Bailey about using silicon carbide to create "local reduction" in red glazes in the electric kiln. He used a fairly typical high-fire copper red base glaze, with 0.5% copper, 0.3% silicon carbide and 1.0% tin oxide added. As is typical for all copper red glaze, the glazes had to be applied fairly thickly.

One thing he discovered is that the particle size of the silicon carbide is critical. He used silicon carbide that ranged from 3 to 50 microns, and discovered that the 9 micron silicon carbide produced the darkest copper red, and 3-5 micron produced the brightest red. This is very small (for comparison, 100-mesh screens are 149 microns, 400 mesh is 37 microns).

His firing cycle was fairly simple:

2 hours to 120 degrees Centigrade

8 hours to 1245 degrees Centigrade

30 minute soak 1245-1240 degrees C

Kiln off

In May 1999 *Ceramics Monthly* magazine also had an article about electric kiln copper reds. This article, by Robert S and Beatrice I Pearson, gave several formulas for cone 5-6 glazes. They used Ultrafine 10 silicon carbide in quantities that were fairly similar to the quantities of copper carbonate in the glaze.

#### COMMERCIAL RED STAINS AND GLAZES & LOW FIRE RED

*Modern commercial glaze stains, (summary of a conversation with Christy Runyan at Georgies):* As many of you know, all of the big ceramic glaze manufacturers quit using lead in their products a couple of years ago. What this has meant for reds and similar colors is that they are now made using "inclusion" pigments. These are pigments where the cadmium is encased in a zirconium shell, and these pigments are very stable in a variety of temperatures and kiln atmospheres. These are getting better and brighter, with broader arrays of colors. They are much more reliable than the old reds and can be fired next to other colors in the kiln.

The old lead/cadmium red glazes were very touchy. They had to be fired fast and in a very clean atmosphere. They could not be placed too near certain other colors in the kiln, and they could not be fired very hot. The new inclusion pigments are much more stable. Many of them can fire very hot, in any atmosphere. If you fire in the cone 04-06 range, Christy points out that the modern low-fire glazes must be fired to at least cone 05 in order to flux properly. Many are fine as high as cone 02.

The modern inclusion pigments need to be used in large quantities (Georgies uses 12% pigment in their cone 6 red), and if you are mixing your own glazes, you may need to add more flux to counteract the large amount of zirconium that they contain.

DeGussa was the original maker of these pigments, but there are now many companies that sell them. All are expensive, but they are amazingly dependable.

*Duncan Underglaze, submitted by Rhoda Fleischman:* I have found that the bright red Duncan underglaze works at cone 12 (bending) in the soda kiln and looks best with just a touch of porcelain clear over it. That's the only red I'm using at the moment.

*Submitted by Frank Gosar:* Here's an easy one: My cone 10 red overglaze is Degussa red stain and Gerstley Borate, equal amounts by volume and diluted in water to the consistency of india ink. For orange I wet-mix equal amounts of red stain and the rutile-water suspension I use for gold.

*Lana's Moss Red, submitted by Janet Buskirk:* I assume this is a Lana Wilson glaze. Cone 04:

Lithium 60  
Talc 40  
Bentonite 2  
Frit 25 or 3403 2  
Manganese Dioxide 6

My notes say that it is lavender when thin, red when thick. Try 3-10% manganese for varying results. Please

note that this does not look like it would be at all safe on food containers.