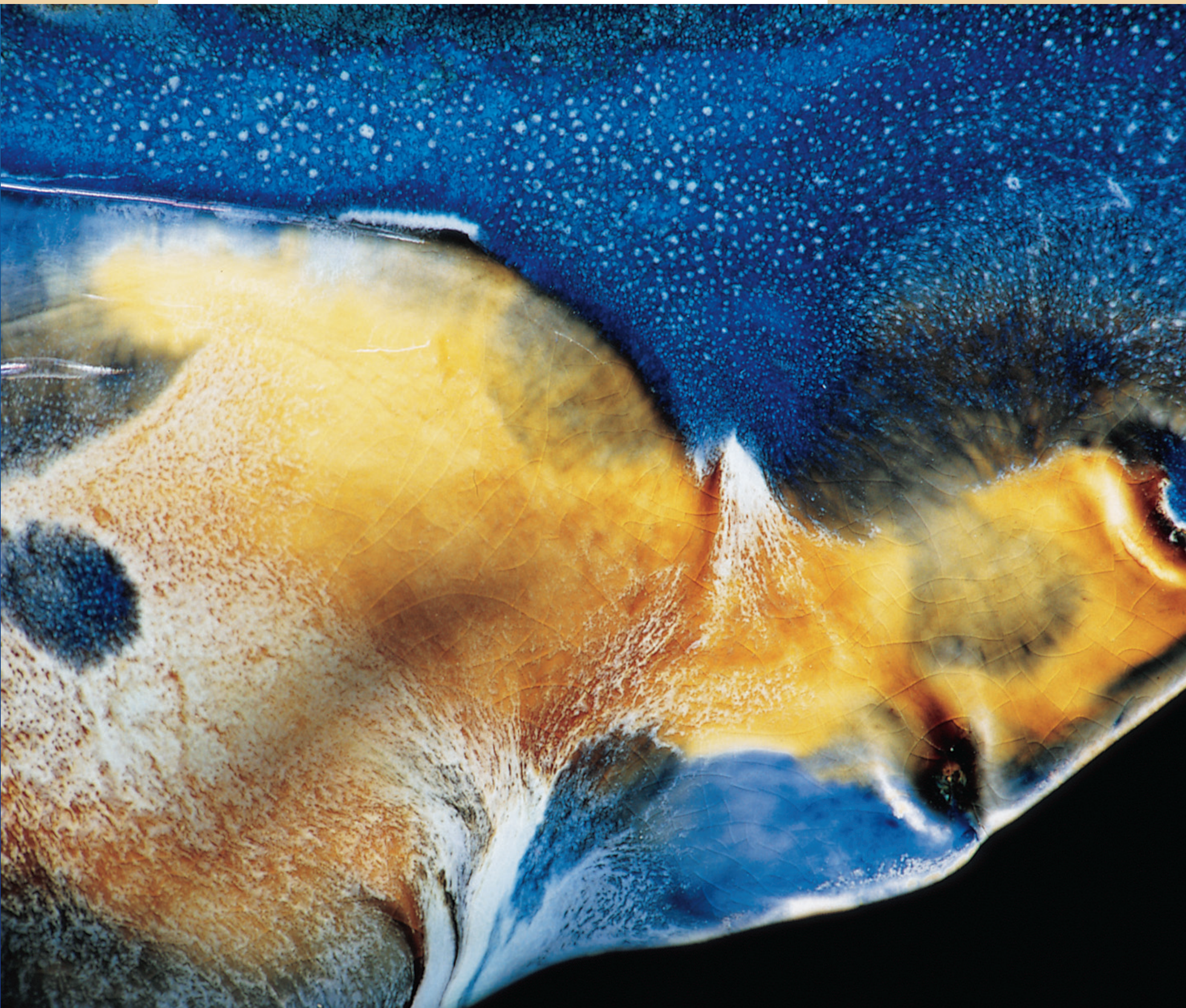
CONE 5–6 GLAZES

2nd Edition

Edited by Bill Jones

Ceramic Arts Handbook Series



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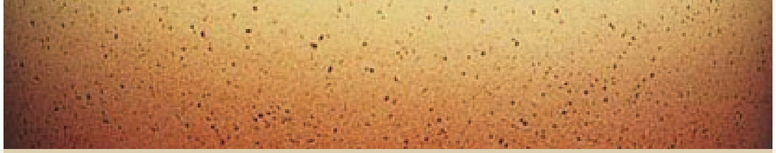

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Preface

For those involved in ceramic art, cone 5–6 is the most common firing range in use today. This has been driven by several factors—the increasing popularity of firing stoneware and porcelain, the desire of traditional high-fire potters to conserve energy at lower temperatures, and the potters working at low-fire looking for the durability that the mid-range offers over earthenware.

As the popularity of mid-range firing increased over the years, the number of potters testing glazes for their own work increased. Many potters who have gained knowledge freely given by others have in turn shared their results. On page 126, Anthony Bellesorte exemplifies this by stating "Because the following recipes work for me, I would like to share them. But I also know how difficult it is to duplicate glaze results. I've tried many glaze recipes that were highly recommended, but was unable to achieve satisfactory results because of differences in raw materials, kiln, water, whatever each potter introduces as an individual set of variables to any glaze equation. Still, these recipes may work as well for you as they do for me."

This book is comprised of materials previously published in *Ceramics Monthly* and *Pottery Making Illustrated* over the past 30 or so years; some have been reprinted in various books or online; and others have been passed around among hundreds of potters at craft centers and schools. Where previously published materials included recipes only as a part of a story or technique, just the recipes and pertinent information have been included.

For anyone who has ever mixed glazes from recipes can attest, results can be anything from surprise to disappointment due to all the variables. First of all, glaze materials are mined, not manufactured so the chemical makeup of materials change over time. For example, feldspars from one part of a mine can vary from another part, or some materials may disappear altogether when a mine closes. For the most part, all recipes remain as originally published, and all ingredients are listed in the Resources with notes concerning substitutions. Additionally, all recipes in this book require testing to allow for the variables introduced by not only materials, but also clay bodies, firing temperatures, cooling rates, mixing styles, even your water supply.

I would like to thank the many potters and ceramic artists who have shared their hard-earned glaze results with readers over the years. Your efforts will continue to be appreciated even by those who have not even begun their clay adventure yet.

Bill Jones

Safety

When mixing glazes, safety should be your main concern. Every supplier is required to keep Material Safety Data Sheets (MSDS) on hand for every material used in a glaze. These contain safe handling procedures and any toxicity warnings. Wearing a HEPA-rated and professionally fitted respirator, safety glasses, and dedicating clothing for the studio will lessen your risks to hazardous exposure. Store materials in plastic containers or approved bins out of reach of children. Heed all warnings for the proper handling of the materials.

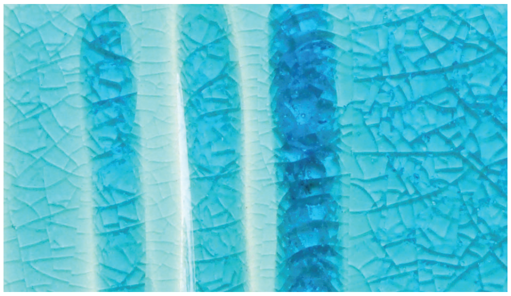
The Basics
CRAZING

by Deanna Ranlett

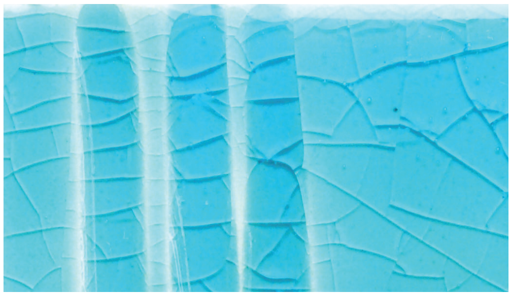
Crazing is a glaze defect where a network of cracks appear in a fired glaze surface. It raises issues of discoloration and the possibility for increased bacterial growth—something you don't want in dinnerware you use regularly. Perhaps you have a favorite teacup that has crazed and you've noticed a change in glaze color over the years as a brown residue works its way through the crazed lines into the clay body. Even commercially made dishes can grow mold when shut in a dark cabinet after a spin through the dishwasher without a heated cycle.

WATER BLUE—ORIGINAL RECIPE
Cone 6

Gerstley Borate	6 %
Ferro Frit 3110	77
EPK Kaolin	7
Silica	10
	100 %
Add: Copper Carbonate	2 %
Bentonite	3 %



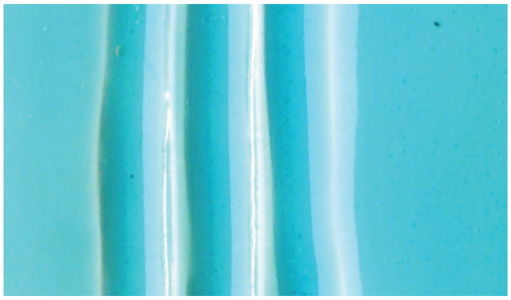
Original Water Blue that creates small, delicate crazing throughout glaze.



Water Blue with 3% Zircopax added and 10% less Ferro frit 3110. Results: Larger, more spaced out crazing.

Water Blue with 5% silica added and 5% less Ferro frit 3110. Results: Larger, more spaced out crazing.

Water Blue with 5% Zircopax and 5% silica added. Results: Largest pattern of crazing.



Results: No crazing. Slightly less transparent due to the addition of the Zircopax.

WATER BLUE REVISION 1
Cone 6

Gerstley Borate	10 %
Ferro Frit 3110	55
EPK Kaolin	15
Silica	15
Zircopax	5
	100 %
Add: Copper Carbonate	2 %
Bentonite	3 %

Results: No crazing. The added EPK kaolin shifts the glaze to a more greenish color.

WATER BLUE REVISION 2
Cone 6

Gerstley Borate	6 %
Ferro Frit 3110	59
EPK kaolin	22
Silica	13
	100 %
Add: Copper Carbonate	2 %
Bentonite	3 %

Glaze crazing also impacts the fired strength of finished ware. I have several customers making beer growlers and the pressure of bottling beer necessitates a solid liner glaze so the vessel doesn't explode. You may not be bottling beer, but the strength and longevity of your work is something to care about. Additionally, if you want to produce ware for the restaurant industry, food inspectors will check food storage and serving ware for this type of defect because crazed glazes can hold bacteria.

Cause and Effect

There are several reasons why glazes craze and several approaches to fix it. Crazing can be aggravated by application and firing—making even a good glaze craze. If you have a glaze that crazes, try testing that involves varying your application from thinner to thicker and compare the results. This will tell you if the glaze is sensitive to thickness. I use a great clear glaze from college but when it's applied too thick, it crazes and when applied thinly, it doesn't.

Clay bodies with high absorption rates can also contribute to crazing. Firing a cone 10 clay at cone 6 can aggravate crazing because the fired ware is still porous and can absorb water and physically swell and expand, causing the glaze to craze. Beyond just firing temperature (to avoid crazing), the coefficient of expansion

Materials
FLUXES

by Dave Finkelnburg

A firm appreciation of fluxes is key to understanding how clay and glazes fire into ceramic art. Fluxes help things melt. Ceramic fluxes lower the melting points of other ceramic materials to temperatures that allow us to use affordable amounts of energy and common equipment and materials. To understand fluxes, though, we need to know what fluxes are and how they work.

Clay, for pottery and ceramic art, is mostly the mineral kaolinite. If pure, kaolinite will not melt unless heated to 3200°F. However, if kaolinite is mixed with a flux, it will begin to melt at a much lower temperature. Fluxes let us fire work at temperatures as low as 1200°F— about what you'd find in an open bonfire. Developing clay bodies and glazes that will fire to specific temperatures requires understanding and controlling the use of fluxes.

Science

As soon as any ceramic material starts to melt, atoms making up the material are freed to move about within the liquid formed. Atoms of any given element within the liquid will move from areas of high concentration of the element to areas of lower concentration. It's like they try to get away from all the neighbors who are just like them and go where the nearest neighbors are not like them. This is the driving force that causes flux elements to diffuse and help dissolve quartz particles in a clay body. There's a lot more going on, of course. Melting of ceramic materials is a complex process. It's important to understand, though, that the chemical composition of the materials in a clay body or glaze ultimately control the temperature and speed of melting.

We often use chemical nomenclature—RO and RO_2—to define our materials (where the letter R is user defined). Since R is not used by any element on the periodic table, it can be used to denote an unknown element in a chemical formula. In ceramics, R refers to one or more of the flux, glass forming, or glass modifying elements we most commonly work with.

We classify flux elements generally as alkali and alkaline earths, and while some fluxing characteristics are specific to each group, many are not. The alkaline earth fluxes fire at a higher temperature while the alkali fluxes melt at a lower temperature and promote brighter colors.

Alkali fluxes are grouped under the label R_2O because it takes two alkali atoms to balance the electrical charge of one oxygen atom. Thus lithium, sodium, and potassium (abbreviated Li, Na, and K) form the oxides Li_2O, Na_2O, and K_2O. Alkaline earth fluxes are labeled RO because it takes only one alkaline earth atom to balance the electrical charge of one oxygen atom. Thus magnesium, calcium, strontium, and barium (abbreviated Mg, Ca, Sr, and Ba) form the oxides MgO, CaO, SrO, and BaO.

Because characteristics beyond general melting temperatures and color response are not particular to one group or another, use these chemical associations carefully. The chart below provides an overview of the effects of the different fluxes. Be aware that the influence of a flux element on glaze color defies classification. For example, magnesium-containing flux materials turn cobalt powerfully purple. In a typical NaKCa-silicate glaze cobalt produces blue. If you begin to remove Ca and replace it with Mg, though, the color will shift to purple. Eventually one can produce a very gorgeous bubble gum grape color without changing the amount of cobalt a bit! Copper is sensitive to different combinations of a number of different fluxes, producing at times blue, yellow, or green. These and other color effects of fluxes must be learned, studied and tested one flux at a time.

FLUXING OXIDE	MELTING TEMP.	CHARACTERISTICS	COLOR AND SURFACE	SOURCE MATERIAL
Li_2O (Lithium Oxide)	1333°F 723°C	can reduce the viscosity and increase fluidity, most reactive flux, strong color response, low expansion/contraction, small particle size	blue with copper, pinks and warm blues with cobalt, textural, variegated effects	lithium carbonate, petalite, spodumene
Na_2O (Sodium Oxide)	1688°F 920°C	strong flux, high expansion/contraction rate causing crazing, begins to volatilize at high temps	copper reds in reduction and copper blues in oxidation	soda feldspar, nepheline syenite, frits
K_2O (Potassium Oxide)	1305°F 707°C	stable, predictable, and active flux, a heavy oxide, high expansion/contraction, crazing in high amounts	promotes bright colors in a broad range	potash feldspar, frits
CaO (Calcium Oxide)	5270°F 2910°C	very active flux in medium/high temp glazes, can harden glaze, intermediate expansion, not an effective flux below cone 4	glossy brown/black to yellow, generally matt surfaces	whiting, wollastonite, feldspars, dolomite
MgO (Magnesium Oxide)	5072°F 2800°C	refractory at lower temps, low expansion and crazing resistance, poor response in bright colored glazes	matt, 'fatty matt' and 'hare's fur' tactile surface	magnesium carbonate, dolomite, talc
SrO (Strontium Oxide)	4406°F 2430°C	useful at lower temps for high gloss and craze resistant glazes, similar expansion and behavior to calcium	satin matt surfaces through a fine crystalline mesh	strontium carbonate
BaO (Barium Oxide)	3493°F 1923°C	very active in small amounts, larger amounts can be refractory and leachable	blues with copper, milky streaks and cloudy effects	barium carbonate, frit
ZnO (Zinc Oxide)	3272°F 1800°C	auxiliary flux in oxidation atmospheres, dramatic color response, low expansion/contraction rate	can produce opacity due to the development of a crystal mesh surface	zinc oxide

Materials

CHROME OXIDE

by John Britt

Chrome oxide is a very powerful colorant that can at times be fickle. It mostly gives a wonderful range of strong greens, but it can also produce blues, browns, and even reds.

Properties and Characteristics

Chrome produces a wide range of greens, from a transparent glossy lime green to the more iconic, opaque, satin kelly green. The strong green color can often be modified by very small amounts of other oxides, like cobalt oxide, copper oxide, iron oxide, manganese dioxide, rutile, tin oxide, etc. In addition to green, chrome oxide also produces gray, brown, red, pink, and orange colors. It is also used in black glazes and stains to give a strong, true black color.

Chrome oxide comes to potters as a bright green powder derived from iron chromate. It is a very powerful colorant—even 0.1% can give a green color. Chrome is unaffected by oxidation and reduction but sometimes glazes that use chrome oxide appear to be affected by reduction because they also contain other oxides to influence their color and those are affected by reduction (like tin oxide, copper oxide, etc.)

Chrome oxide is an amphoteric oxide, which means it plays an intermediate role between fluxes and silica. It is generally very refractory and not very soluble in a glaze melt but sometimes it acts as a flux, e.g. as with the acidic tin oxide. The exact color it produces depends on the role chrome is fulfilling in the glaze. For example, in high alkaline or high boron glaze bases, when less than 1% chrome is added, it can dissolve well and give bright glossy transparent greens, (see Odyssey series 0.15/0.5%). In a zinc (zinc chromate) base it produces browns (see Chun glazes). In a high calcium or high strontium base without zinc, it can produce pinks, or crimson to burgundy colors (see Raspberry and Cranberry glaze). In a glaze that contains tin oxide, adding chrome pushes it toward shades of pink. The colors of chrome-tin pinks can be quite variable but consistent chrome-tin colors can be achieved by using commercial stains where the chrome and tin combination have been pre-melted together.

Because chrome oxide is volatile, placing a chrome green glaze next to a tin white glaze will often produce pink flashes on the tin white glaze. A good kiln vent can help to pull out the chrome fumes before they have time to latch onto the tin whites. But chrome flashing is best avoided by not mixing the two glazes in the same firing. Alternatively, if you like the pink flashing, this can be encouraged by mixing chrome greens and tin whites in a firing or even firing pieces in a partially closed saggar with a chrome green glaze painted on the inside wall of the saggar.

RASPBERRY AND CRANBERRY
Cone 6

Whiting	20.0 %
Ferro Frit 3134	14.0
Nepheline Syenite	18.0
Kentucky OM4 Ball Clay	18.0
Silica	30.0
	100.0 %

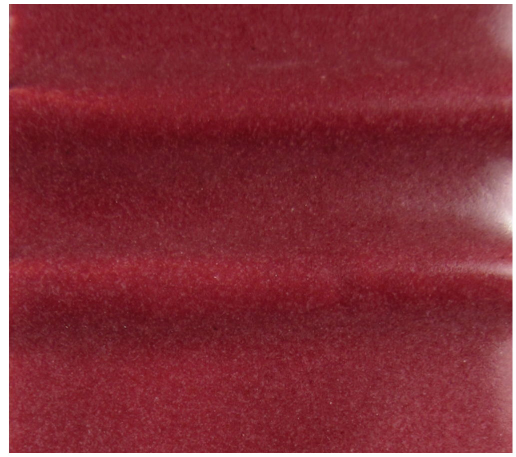
RASPBERRY

Add: Tin Oxide	7.5 %
Chrome Oxide	0.2 %

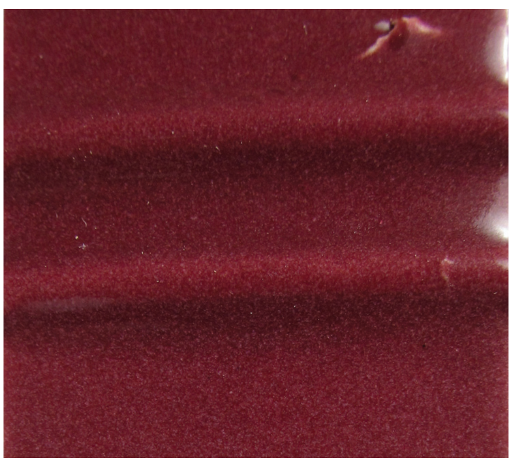
CRANBERRY

Add: Tin Oxide	3.8 %
Chrome Oxide	0.2 %

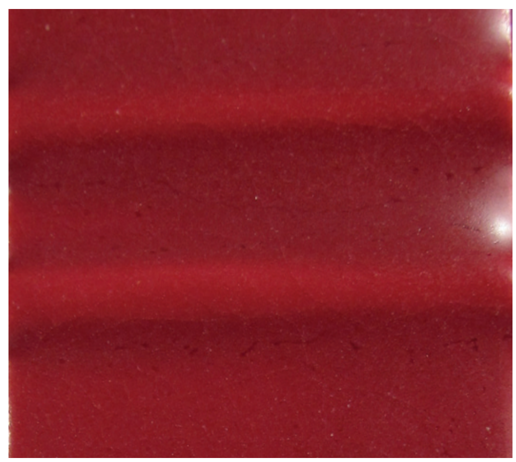
From *Mastering Cone 6 Glazes* by John Hesselberth and Ron Roy.



Raspberry base

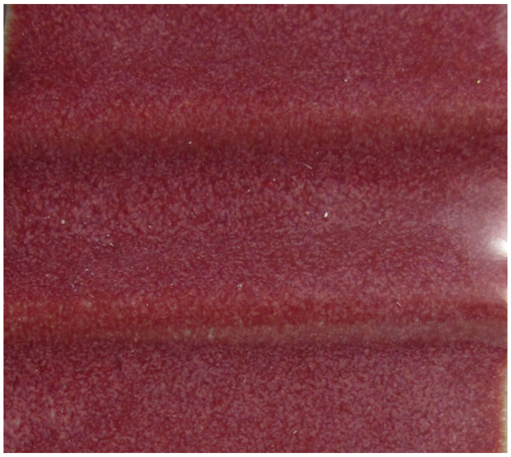


Raspberry base with 0.25% cobalt carbonate

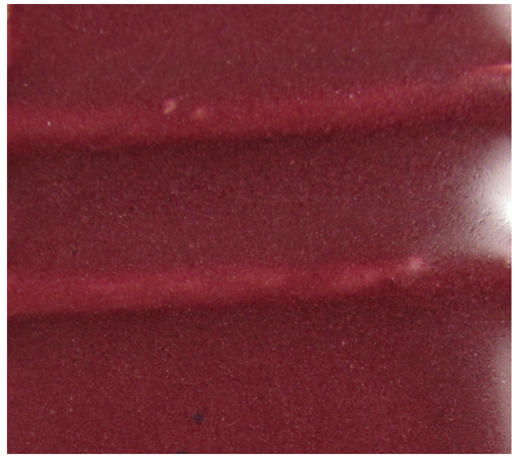


Raspberry base with 8% Mason 6006 Stain

Chrome oxide gives a burgundy/red when combined with tin oxide at cone 6 in oxidation (see Raspberry, Cranberry or Chrome Red glazes). This iconic cone 6 glaze needs a specific formulation to be successful. First, there needs to be a specific ratio of tin oxide to chrome oxide. Start with 0.1–0.5% chrome oxide and 7.5–9.0% tin oxide. Remember that these are targets that should help you, but you can get red colors to develop with less amounts of tin oxide (see Cranberry glaze with 3.5% tin oxide). Varying the amounts will give a variety of pinks to deep burgundy colors. The calcium content of the glaze should be high (10–15% or 0.7–0.9 moles). It is also important to have no zinc in the recipe or the glaze will turn brown. Alumina is also best if kept low. Some recommend no magnesium oxide (talc, dolomite, or magnesium carbonate) in the base recipe while others use small amount of MgO to achieve interesting red/burgundy colors (see Burgundy/Red glaze). A thin application is best as a thicker coating may produce a gray glaze.



Burgundy Red



Chrome Red with 0.25% cobalt carbonate

BURGUNDY/RED
Cone 6

Gerstley Borate	8 %
Talc	4
Whiting	21
Ferro Frit 3134	9
Custer Feldspar	31
EPK Kaolin	9
Silica	18
	100 %
Add: Tin Oxide	5.00 %
Chrome Oxide	0.20 %

CHROME RED
Cone 6

Gerstley Borate	21 %
Whiting	20
Nepheline Syenite	16
EPK Kaolin	11
Silica	32
	100 %
Add: Tin Oxide	5.00 %
Chrome Oxide	0.15 %

You can also get chrome/tin reds at low-fire temperatures but they don't work well above cone 8. If you don't want to mess with the ratio of tin to chrome, an easy way to get cone 6 burgundy reds is to simply add 5–8% stain, such as Mason Deep Crimson 6006, (which contains calcium, chrome, tin, and silica), to a high-calcium base glaze (see Cranberry glaze).

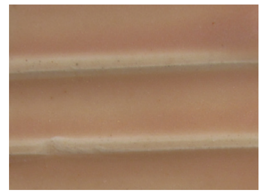
Adding cobalt carbonate to a chrome/tin or burgundy/red can push the glaze toward purple but adding too much will overpower the red (see Raspberry and Chrome Red glaze tiles with added cobalt carbonate). You can also alter the tone of the burgundy/red glaze with small additions of iron oxide, rutile, or manganese dioxide.

Toxicity: While there is no legal limit set for safe leaching of chrome in glazes, potters should be aware that the legal level of allowable chrome oxide deemed safe for drinking water is 0.1 mg/L (ppm). Because chromium can have different valences, its toxicity and carcinogenic effects vary greatly. It is volatile at higher temperatures and is a toxic fume (fugitive chrome). Care should be taken when handling and firing chrome compounds.

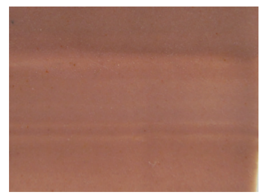
CHUN BASE
Cone 6

Whiting	14 %
Zinc Oxide	12
F-4 Feldspar	38
Kentucky Ball Clay	6
Silica	30
	100 %

A great cone 6 electric base that is a nice clear and gives excellent colors except with chrome because it contains zinc, which turns brown.


Chun Base with 0.15% chrome


Chun Base with 0.5% chrome


Chun Base with 1.0% chrome


Chun Base with 2.0% chrome

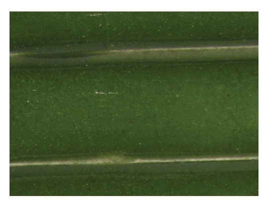
ODYSSEY BASE
Cone 6

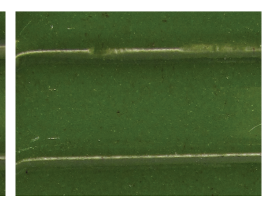
Gerstley Borate	20%
Whiting	10
Nepheline Syenite	30
EPK Kaolin	10
Silica	30
	100%

A standard base from the Odyssey Center in Asheville, North Carolina. Contains high boron, calcium, and sodium, gives bright, glossy, transparent colors.


Odyssey Base with 0.15% chrome


Odyssey Base with 0.5% chrome

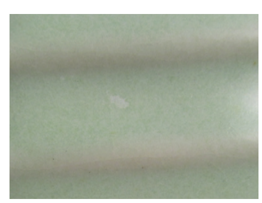

Odyssey Base with 1.0% chrome

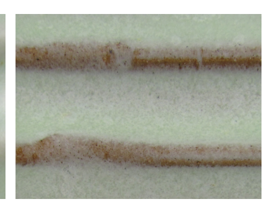

Odyssey Base with 2.0% chrome

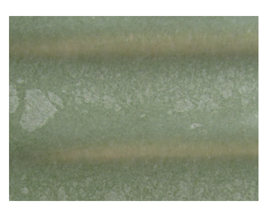
RANDY'S BASE
Cone 6

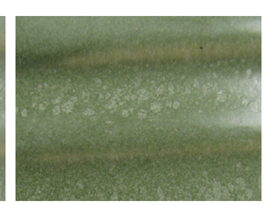
Gerstley Borate	31.7 %
Talc	13.8
F-4 Feldspar	19.8
EPK Kaolin	5.0
Silica	29.7
	100.0%

An excellent and popular base (originally from Randy's Red). Contains a lot of boron and low alumina, gives bright, glossy, transparent colors.


Randy's Base with 0.15% chrome


Randy's Base with 0.15% chrome on stoneware


Randy's Base with 0.5% chrome


Randy's Base with 1.0% chrome

Expanding a Palette
ALTERING THE FIRING

by Deanna Ranlett

Down firing, or slow cooling, refers to controlling the rate at which your kiln cools. I've programmed my kiln to a slowly cooling rate for a variety of purposes, ranging from slow cooling large work to reduce dunting to cooling slowly and holding at certain temperatures to form glaze crystals. Slower cooling reduces stress on ceramic wares and is well worth the extra time. For glazes containing zinc, rutile, calcium, magnesium, lithium, and iron (to name just a few), slowing the cooling rate can result in some spectacular effects, ranging from feathering to small crystals and in some cases a fully-developed satin-matte surface. The combination of a short soak at peak temperature and then down firing can also eliminate pin holing in some glazes (figure 1).

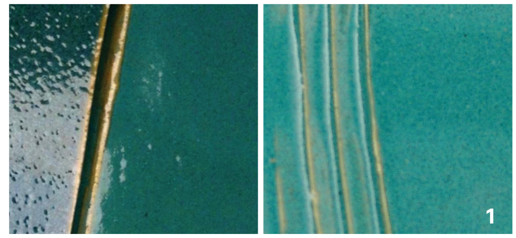
Many new computer controlled kilns come with built-in preheat or cool-down programs, but I have an older model computer-controlled kiln so I program my own firings. *Tip:* If you plan to use a pre-program set-up, test the program in a typical firing using self-supporting Orton cones to calibrate the kiln. The type of kiln, type of ware being fired, and the size and density of the average ware stack inside the kiln can impact final temperature determinations, but this initial calibration firing gives you a baseline for the length of the firing to reach a specific temperature.

Over the years, I've determined that the pre-programmed cone 6 firings tend to overfire my work. I tend to pack my kiln very full and the result of the pre-programmed firing schedule finishes closer to cone 7 than to cone 6. As a result, I've researched additional down-firing schedules and came across Ron Roy and John Hesselberth's *Mastering Cone 6 Glazes* book. In the appendix, I found a perfect starting point for a cone 6 down-firing. To this initial schedule, I've made adjustments to suit the way the kiln is loaded, and to take into account what the self supporting cones told us about the firing speed, and the end temperature. I've also learned that generally, the slower the climb to temperature, the lower the end temperature, so programming a hold at your desired peak temperature also impacts what the end shut-off temperature should be because heat work continues to occur during those slower periods. A hold at the end of a firing allows a slight soaking effect which allows all work to reach temperature if there's any unevenness inside the kiln from top to bottom. It also allows glazes to move together and flatten a bit, which is great if you're creating a reduction-fired effect by layering multiple glazes. Refer to your kiln manual or manufacturer's website for proper programming instructions.

If you're down firing for crystalline growth, you want to keep the glaze fluid enough so that crystals can form but not so fluid that it starts to run. In my experience, it's best to hold the glaze firing for fifteen minutes to about 60° lower than the cut off temperature for a pre-programmed firing. To begin controlled cooling, allow the kiln to cool as

KAREN'S STARSHINE
Cone 6

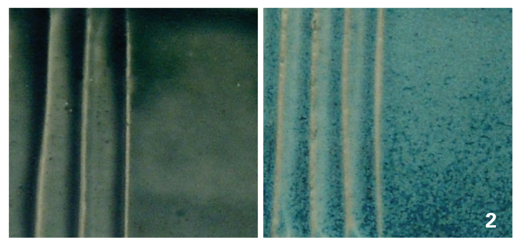
Custer feldspar	51%
Whiting	13
Gerstley Borate	6
Soda Ash (dissolve in hot water)	4
Strontium Carbonate	4
Lithium Carbonate	1
Titanium Dioxide	4
Silica	21
	100%
Add: Copper Carbonate	5%



Karen's Starshine. Left: Fired on a medium speed cone 6 program, results are translucent, glossy, pinholed. Right: Fired to the cone 6 program on page 72, results are opaque, glossy, smooth.

DIXIE TEAL
Cone 6

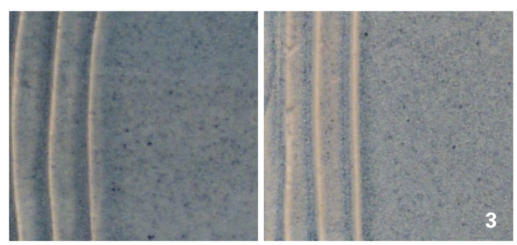
Gerstley Borate	2.9%
Ferro Frit 3124	8.8
Magnesium Carbonate	2.9
Whiting	22.4
Nepheline Syenite	22.7
EPK Kaolin	20.3
Silica	20.0
	100.0%
Add: Copper Carbonate	4.0%
Cobalt Carbonate	3.0%



Dixie Teal. Left: Fired on a medium speed cone 6 program, resulting in a glossier, darker color. Right: Fired to the cone 6 program on page 72, resulting in a lighter, speckled glaze.

FROST
Cone 6

Ferro Frit 3134	20.0%
Nepheline Syenite	30.0
Whiting	10.0
Talc	17.0
EPK Kaolin	13.0
Silica	10.0
	100.0%
Add: Zircopax	10.0%
Rutile	3.0%
Cobalt Carbonate	0.5%
Copper Carbonate	1.0%
Bentonite*	3.0%

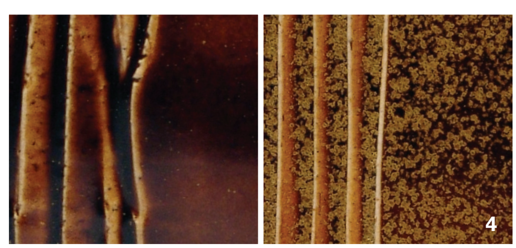


Frost. Left: Fired on a medium speed cone 6 program, resulting in a glossier, darker color. Right: Fired to the cone 6 program on page 72, resulting in a frostier, satin surface.

JOHN'S TENMOKU
Cone 6

Custer Feldspar	43%
Whiting	21
EPK Kaolin	10
Silica	26
	100%
Add: Red Iron Oxide	16%
Bentonite*	3%

* Weigh the bentonite separately and dry mix it with the other ingredients before adding water.



John's Tenmoku. Left: Fired on a medium speed cone 6 program, resulting in a glossier, darker in color. Right: Fired to the cone 6 program on page 72, resulting in gold crystals formed when cooling.

fast as it can for the first 300° so the controlled portion of the firing is taking place about 300° lower than the cut-off temperature. I have experimented with different cooling rates ranging from 125° per hour to 175° per hour depending on the type of glazed surface I desire. To prevent dunting (cooling cracks) in a sculpture firing program, the cooling period isn't done for development of glazes but to minimize fast heat loss around larger work. I recommend a cooling rate of about 200° per hour through quartz inversion (1063°F).

Crystal growth in some glazes can vary depending on the rate of down firing—a fast cool results in a glossy surface, while a slow cool goes matte (figure 2). The crystals creating the satin surface are happening between 1900°F and 1450°F. Some glazes can form small crystals during the soaking period but for the most part, the controlled cooling is allowing the crystalline structure to form. Caution: Make sure that your glazes aren't becoming less stable or less food-safe due to changes in surface texture from crystals forming in the glazes. Perform leach tests on all results.

Controlled Cooling in a Manual Kiln

While controlled cooling is more difficult in a manual kiln, it's not impossible. You can re-engage your kiln sitter, which forces your kiln to remain on despite the cone dropping. This is where things can get a little tricky, so you would want to make sure you set your safety timer as a back-up in case you get interrupted and don't remember to turn off the kiln.

Let the kiln sitter drop and allow the kiln to remain off for 15–20 minutes—the temperature drops rapidly when the kiln first shuts off. After this, use a combination of medium and low switches to create gentle heating as the kiln cools—try 1–2 hours on medium, then 1–2 hours on low so the kiln cools by about 125–175° per hour. This allows extra time for your glazes to develop a crystal structure or for large sculpture to cool slowly. Keep a log of all your changes and results so you can make adjustments to the timing you used to turn switches to medium or low on the down firing.

Down-Firing Kiln Schedules (right)

Because the bisque firing has already changed the clay into ceramic material, temperatures can increase faster through the middle of the glaze firing.

Cone 04 Bisque Firing

This program controls cooling for large sculptural ware and prevents cooling cracks.

- 50° per hour to 150°F—hold 2–6 hours This depends on the size of your work and its dryness
- 150° per hour to 200°F—hold 15 minutes
- 250° per hour to 1000°F—no hold
- 180° per hour to 1150°F—hold 15 minutes
- 300° per hour to 1800°F—no hold
- 108° per hour to 1900°F—hold 5 minutes

On the way down:

- 150° per hour to 1500°F—no hold
- Cool naturally from 1500°F. For large-scale work, cool through quartz inversion (1063°F) at a rate of about 200° per hour, then allow the kiln to cool naturally from 600°F down to room temperature.

Cone 6 Glaze Firing

This program controls cooling for special glaze effects.

- 100° per hour to 220°F—no hold
- 350° per hour to 2000°F—no hold
- 150° per hour to 2185°F—hold 15 minutes (I use 2175°F to a half-bent cone 6 self-supporting cone)

On the way down:

- 500° per hour to 1900°F no hold (I program my kiln for 9999°F to 1900°F so that I don't get an error message if the kiln can't cool at that rate)
- 125–175° per hour to 1450°F—use your glaze results to tell you if this rate should be slower or faster in subsequent firings.
- Allow the kiln to cool naturally from 1450°F down to room temperature.

Bill Jones is the former manager of the Ceramic Arts Daily books program for The American Ceramic Society, and was the founding editor of *Pottery Making Illustrated*. He received a BFA in studio ceramics from The Ohio State University in 1970. His career includes working for glaze and supply companies, and operating a ceramic studio pottery prior to entering publishing. He currently resides in Gambier, Ohio, and continues to work in clay and occasionally test glazes at his studio there.

Whether you're just getting started with making glazes or you're a seasoned pro, there's something for everyone in this new edition of *Cone 5–6 Glazes: Materials and Recipes*. This edition features the research of more than thirty potters and glaze enthusiasts who dedicated hundreds of hours of research into finding and understanding materials and glazes that provide the right effect for their pots. Bringing together a wealth of information published in *Pottery Making Illustrated* and *Ceramics Monthly* and over the past 30+ years, this book will be an invaluable resource in any ceramic library.

In *Cone 5–6 Glazes* you'll discover an easy way to test, tips for glazing, and insights into key glaze materials such as frits, feldspars, iron, commercial stains, and more. If you're looking for glazes with a special effect, you'll find snowflake crackles, crystals, Bristols, purples and bronzes just to name a few. And of course there are recipes—all in the cone 5–6 oxidation firing range. Whether you're an old pro or new to making glazes, you'll discover a wealth of inspiring information that will help you develop a personal palette for your ceramic work that you can call your own.

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