

# INTERMEDIATE RAKU

## Introduction

In our beginning raku classes, we often compare raku to chess: we can teach you the moves in an afternoon, but you can spend a lifetime mastering the game. The purpose of this flyer is to introduce you to some advanced moves that will expand your color palette and creative possibilities.

## Oxidation vs. Reduction

During raku firing, you are balancing or juggling oxidation and reduction atmospheres in both the kiln and the reduction chamber to get the effects you want. Oxidation and reduction are not really polar opposites: they represent more of a continuum. Either color result can be desirable.

**A) Oxidation Atmosphere:** this means that oxygen is present in the firing atmosphere. Copper oxides fired in oxidation atmospheres produce shades of green and blue, and also produce metallic flashes and iridescence. Think of a copper or bronze statue standing in the outdoors and weathered by the elements.

**B) Reduction Atmosphere:** oxygen is not present in this firing atmosphere. Reduction atmospheres in raku are rarely completely oxygen-free, but oxygen is present in lesser percentages than in the atmosphere we breathe. Copper oxides fired in reduction produce darker shades, from tomato red to oxblood red to purple. The same metal (copper) changes color in reduction because sustaining the fire requires oxygen. If there is insufficient oxygen in the atmosphere inside the kiln or reduction chamber, the fire will rip the oxygen it needs out of the metallic oxide in the glaze.

**C) Influencing the Atmosphere:** you may not be able to completely control the atmosphere in raku, but you can influence it toward your desired color results. You can induce reduction in either the kiln or the reduction chamber (or both), or promote oxidation before placing pieces in the reduction chamber.

### Reduction in the Kiln:

- a. The first step toward reduction in the kiln is altering the position of the primary air intake using the screw-mounted plate, at the back of the burner. Screw the plate toward the burner to restrict air flow into the burner. This creates a fuel-air mixture richer in fuel, so less oxygen is sucked into the kiln. If you screw the plate down too far, you will starve the burner and extinguish the flame.
- b. A second step to promote kiln reduction is to partially block the kiln flue with a kiln shelf or brick. This prevents the full exhaust of combustible gases in the kiln.
- c. Start reduction in the kiln when the glazes begin to melt and bubble. At this point, there is enough heat contained in the kiln to force a complete burn of the fuel.

### Glaze combination #1

80% PG805 White Crackle  
20% PG811 Blue Dolphin



### Glaze combination #2

75% PG805 White Crackle  
25% PG802 Copper Flash



### Glaze combination #3

50% PG805 White Crackle  
50% PG812 Copper Ridge



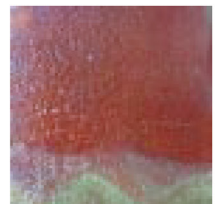
### Glaze combination #4

50% PG813 Michigan Patina  
50% PG811 Blue Dolphin



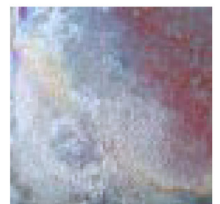
### Glaze combination #5

75% PG805 White Crackle  
25% PG807 Opal Shimmer



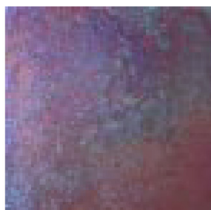
### Glaze combination #6

50% PG808 Beetle Juice  
50% PG811 Blue Dolphin



*Georgies*  
CERAMIC AND CLAY CO.

756 NE Lombard St • Portland OR 97211 • 503-283-1353 • [www.georgies.com](http://www.georgies.com)

**Glaze combination #7**

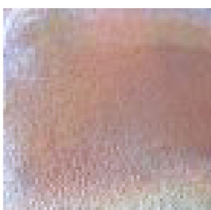
75% PG808 Beetle Juice  
25% PG811 Blue Dolphin

**Glaze combination #8**

50% PG808 Beetle Juice  
50% PG812 Copper Ridge

**Glaze combination #9**

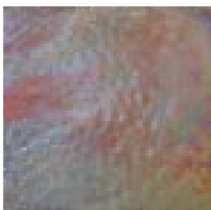
50% PG808 Beetle Juice  
50% PG813 Michigan Patina

**Glaze combination #10**

50% PG808 Beetle Juice  
50% PG802 Copper Flash

**Glaze combination #11**

50% PG808 Beetle Juice  
50% PG813 Michigan Patina

**Glaze combination #12**

50% PG801 Apple Crackle  
50% PG811 Blue Dolphin

d. If you start kiln reduction too soon, the fuel will not burn completely, and it will deposit a fine gray soot on your pieces. It first appears at the edges, corners and lips of your pieces. Soot is the product of an incomplete burn. It can be burned off “if” there is enough oxygen present, but that goes against the point of kiln reduction. If this soot gets into and under your glaze as the glaze melts, it will turn your pieces into a semi-glossy uniform gray/silver gunmetal color. Bleh.

**Reduction in the Reduction Chamber:**

- a. Few things are really, truly airtight. Many types of containers used for reduction will leak air (and oxygen) toward your pieces. For heavier post-firing reduction, your goal is to minimize oxygen leakage.
- b. Try a smaller container for some of your pieces, like a 10-gallon can instead of a 20-gallon. With less volume, there is less initial oxygen.
- c. “Seal” the mouth of the can with a newspaper “gasket”. Lay several sheets of newspaper across the inside of the lid and spray them with water. When you put the lid on the can, you want the newspaper to stick out all the way around the edges. The water will keep it from burning (although, it may scorch). This gasket also holds the smoke in, and keeps the smoke pressure high for good smoke blackening. Plus your neighbors may appreciate it, too.
- d. Use denser materials, like sawdust or shredded paper, instead of torn newspaper. In the brief time before it ignites, denser materials will shield oxygen away from your pieces. Every bit helps.

**Oxidation in the Kiln:**

- a. The simplest, most reliable and safest way to promote oxidation is to allow your pieces to cool in the kiln before placing them in reduction. Shut off the gas, open the kiln, and just let them sit. The natural draw of heat escaping the kiln draws air through the kiln body. Depending on the size and number of your pieces, you may let them cool anywhere from 10-40 seconds.
- b. Use larger containers or more loosely packed materials.
- c. Remember that the net reduction effect of several small pieces can equal the effect of one large piece. The crucial factor is mass, and how much heat energy that mass contains. This is something to experiment with, as every artist’s work is different.

**Blending Glazes**

Georgies makes 14 raku glaze formulas -- but your color palette does not stop there. If you experiment with blending the glazes in different proportions, you can open up hundreds of new color and surface possibilities. There are basically two ways to blend glazes: **brushovers** and **liquid mixes**.

When blending glazes, the basic “color wheel rules” apply. Darker glazes like Midnight Luster and Copper Penny will dominate lighter colored glazes like Beetle Juice and Piepenberg Red-Bronze. The lighter colored glazes will tend to blend in and disappear.

**A) Brushovers:** is just what it sounds like: brushing one coat of a glaze on top of another. Pigments are picked up and moved as glazes flux and boil. This leads to “frayed” edges and a color-washed or marbelized appearance. Here are some specific tips on brushovers with our glazes.

- a. A white crackle base adds visual depth behind other glazes,

as light gets “trapped” and bounces around inside the glaze. The piece almost seems to glow from within. It also adds and accentuates glaze crackles, which are present with most gloss glazes.

**b.** Blue Dolphin gives excellent results over White Crackle. Not all matte glazes, however work over the White Crackle base. Opal Shimmer tends to clump up, forming bumps that rise from the surface.

**c.** Color and texture results may vary with the same glazes, depending on which one you put on first.

**d.** When planning brushovers, take into account the application textures of your glazes.

**e.** Keep in mind that you may be putting more glaze on your piece than normal: this may lead to extra glaze runs and drips. You may also need extra firing time to evenly distribute the pigments.

**B) Liquid Mixes:** this is where the color and texture palette really opens up. For the purposes of this flyer, we have primarily focused on the 50:50 glaze mixes. If you experiment with different proportions, there are hundreds more possibilities. The field is wide open, as well, for 3-way or 4-way mixes. This is an area that takes a lot of experimentation with your work, but can yield some great results.

**a.** You can measure the proportions precisely if you wish, or by eyeball.

**b.** Mix the glazes thoroughly.

**c.** Color distribution will be more even with liquid glazes.

**d.** Application characteristics of the mixes will borrow some from both or all glazes involved, and textural results will also vary.

**e.** Firing characteristics and textural results will also vary.

**f.** Matte glazes are powerful, in the sense that their texture tends to overrun the gloss glazes. In a 50:50 mix, the matte glaze takes over. To “borrow” pigments and create a textured or semi-gloss glaze, use no more than 20% to 30% of the matte glaze. That’s plenty.

## Commercial Glazes & Underglazes

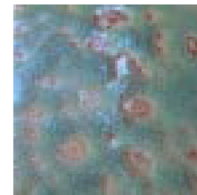
In this area of palette exploration, we’re bargaining on the fact that raku is a lowfire glaze process. It’s the reduction part of the process that really sets raku apart from lowfire work. The target temperature for raku glazes and the target temperature for commercial lowfire products is roughly the same: cone 06. Exact color results will depend on the commercial glaze’s formula -- not just the pigment, but also the raw materials. There are some challenges and differences in the two types of products that should be taken into account when using and firing them.

First, most lowfire glazes will not flash to create lusters in reduction. They simply don’t contain enough raw oxides. These glazes can be used for color, design work, and area contrasts with glazes that will “luster up”, either raku glazes or other commercial glazes.

The good news is that there are a few commercial glazes which will flash. These formulas are copper-based. You can identify them because they’re marked “Not Overglaze Compatible.” These few glazes will flash beautifully.

### **Glaze combination #13**

50% PG8051 Apple Crackle  
50% PG808 Beetle Juice



### **Glaze combination #14**

50% PG8051 Apple Crackle  
50% PG806 Midnight Luster



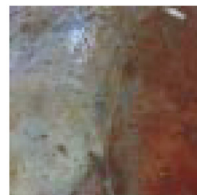
### **Glaze combination #15**

50% PG808 Beetle Juice  
50% PG803 Copper Penny



### **Glaze combination #16**

50% PG803 Copper Penny  
50% PG813 Michigan Patina



### **Glaze combination #17**

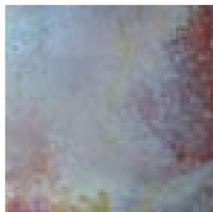
50% PG803 Copper Penny  
50% PG812 Copper Ridge



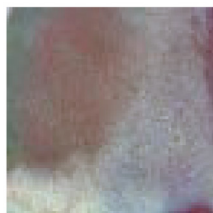
### **Glaze combination #18**

50% PG802 Copper Flash  
50% PG803 Copper Penny

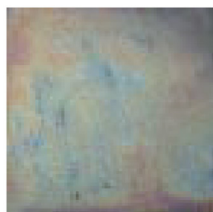




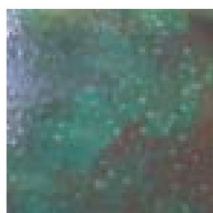
**Glaze combination #19**  
50% PG803 Copper Penny  
50% PG813 Michigan Patina



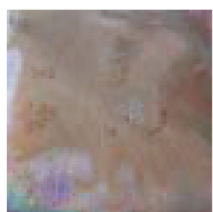
**Glaze combination #20**  
50% PG808 Beetle Juice  
50% PG807 Opal Shimmer



**Glaze combination #21**  
50% PG813 Michigan Patina  
50% PG812 Copper Ridge



**Glaze combination #22**  
50% PG801 Apple Crackle  
50% PG813 Michigan Patina



**Glaze combination #23**  
50% PG813 Michigan Patina  
50% PG807 Opal Shimmer

Second, most lowfire commercial glazes are formulated to melt slowly under the heat. The slow melt helps ensure they won't run and ruin someone's design work. Raku is a violently fast firing process. Some commercial glazes, when forced to fire fast, may not smooth down completely from their flying as they melt. Or, you may find that you need a couple extra minutes in the firing to smooth them down. (In this case, be careful of overfiring!)

Third, there is a possibility that some may not work at all in raku. Experiment, experiment ...

French Dimensions are a raised glaze product, intended for use as design accents for lettering, dots, etc. They work great in raku, but may tend to run or slip on gloss glazes. Be careful, too, not to squash them with your tongs.

**A) Coloring Glaze with EZ Strokes:** Duncan EZ Strokes are translucent underglazes, intended to give a "watercolor" look. In conventional lowfire ceramics, they're used for design work where you want the brushstrokes to show. They're primarily used on lowfire greenware. In raku, you can get good results mixing them with White Crackle to produce a variety of glaze colors. The depth of color depends on the amount of EZ Stroke used.

- a. EZ Strokes are basically pigment and water, with a small amount of flux added so the pigments will stay put and adhere to clay. This means minimal "contamination" of your base glaze formula. White Crackle will still produce crackles.
- b. Using EZ Strokes is similar to coloring your glaze with Mason Stains, with the advantage that the pigment is already mixed and hydrated. It's easier and quicker.
- c. Color results will probably always be mottled or "watercolored".
- d. For most thorough color distribution, use an electric hand mixer or run through a small blender.
- e. Some shades may not produce enough of the color you want: very light shades will take more EZ Stroke to produce color -- but this runs into the issue of changing your glaze flux.
- f. You're also adding liquid to your glaze: it may take more application coats than normal to produce good glaze coverage.
- g. Comparable products include Mayco Stroke & Coats, and others labeled "translucent underglazes".

**B) Raku Glazes over Underglazes:** The commercial glaze manufacturers also have a series of opaque underglazes, intended primarily for design work on lowfire greenware. These can also be used with raku glazes, especially White Crackle. Remember that White Crackle is not actually a "white" glaze: it's a clear glaze, and reflects the color of the clay underneath. You can use this to your advantage for design work.

Generally speaking, we would not recommend using colored raku glazes over underglaze design work. When the raku glazes produce lusters, some of your design work may be obscured ... but that's also another thing you could use and incorporate. The amount of underglaze you use will make a significant difference in the glaze performance, and not only for the reasons that you might expect. The pigments in some underglazes may change the glaze chemistry. The cobalt in some blue or black underglazes may act as an extra flux, causing the glaze to run or move more than you expected, or desired. Like so many other areas in ceramics, a little experimentation goes a long way!

*Georgies*  
CERAMIC AND CLAY CO.

756 NE Lombard St • Portland OR 97211

503-283-1353 • [www.georgies.com](http://www.georgies.com)