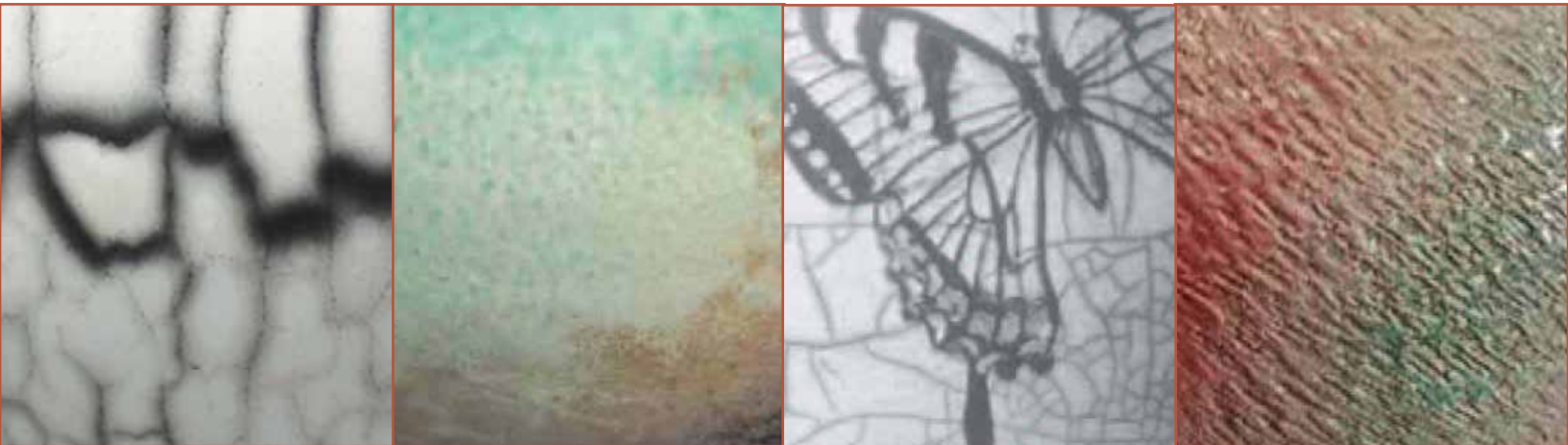


successful tips & techniques for raku firing



how to raku and select
raku pottery clays, glazes,
kilns, and combustibles

Successful Tips and Techniques for Raku Firing:

How to raku and select raku pottery clays, glazes, kilns, and combustibles

Raku firing is exciting and fun. Whether you're raku firing in your own studio or taking part in a group raku firing at a school, workshop or community center, raku offers many rewards. Raku firing is one of the most exciting processes in ceramics. After you place your pottery into a hot raku kiln, the anticipation builds as you wait for that final moment when the intense heat begins to melt the raku glazes. When you remove the pieces, you can feel the heat and hear the pings of your red hot work rapidly cooling, then it's into the raku combustibles for a round of flame and smoke. Many surprises await you as you clean the surface and reveal the wonders of raku pottery.

How to Raku

by John Ramer Sherrill

Raku pottery is tremendously popular. The wide range of raku glazing and raku firing methods, and the surprises that come from every firing hold the interest of potters everywhere. While many achieve consistent results, many potters as well as students have been unhappy with their raku attempts. Here is a rundown of the basics you need for success at firing raku.



Raku Clay

by Bill Jones

The raku firing process requires a porous non-vitrified clay that can withstand rapid heating and cooling without cracking or breaking from the thermal shock. By this definition, any clay that can withstand such stresses can be considered a raku clay; however, some clays will provide a greater degree of success. When deciding on a suitable raku pottery clay, your chances for success increase with bodies specifically formulated or adjusted for the raku pottery process.



Raku Glazes

by Steven Branfman

A raku glaze is any glaze you use in the raku pottery method. It doesn't have to be a glaze specifically designed for raku, formulated to fire at the temperature you fire your raku ceramics to, nor homemade or commercial. Read how your raku glaze can be most anything. The key to success is understanding the raku firing process and the ability to predict how a particular glaze reacts to that process.



Buying a Raku Kiln

There are many configurations for raku kilns—top loaders, front loaders, top hats, car kilns, and clam shells. Here's a brief overview of what you need to know to buy the raku kiln you need.

Pop Goes the Slip! Naked Raku

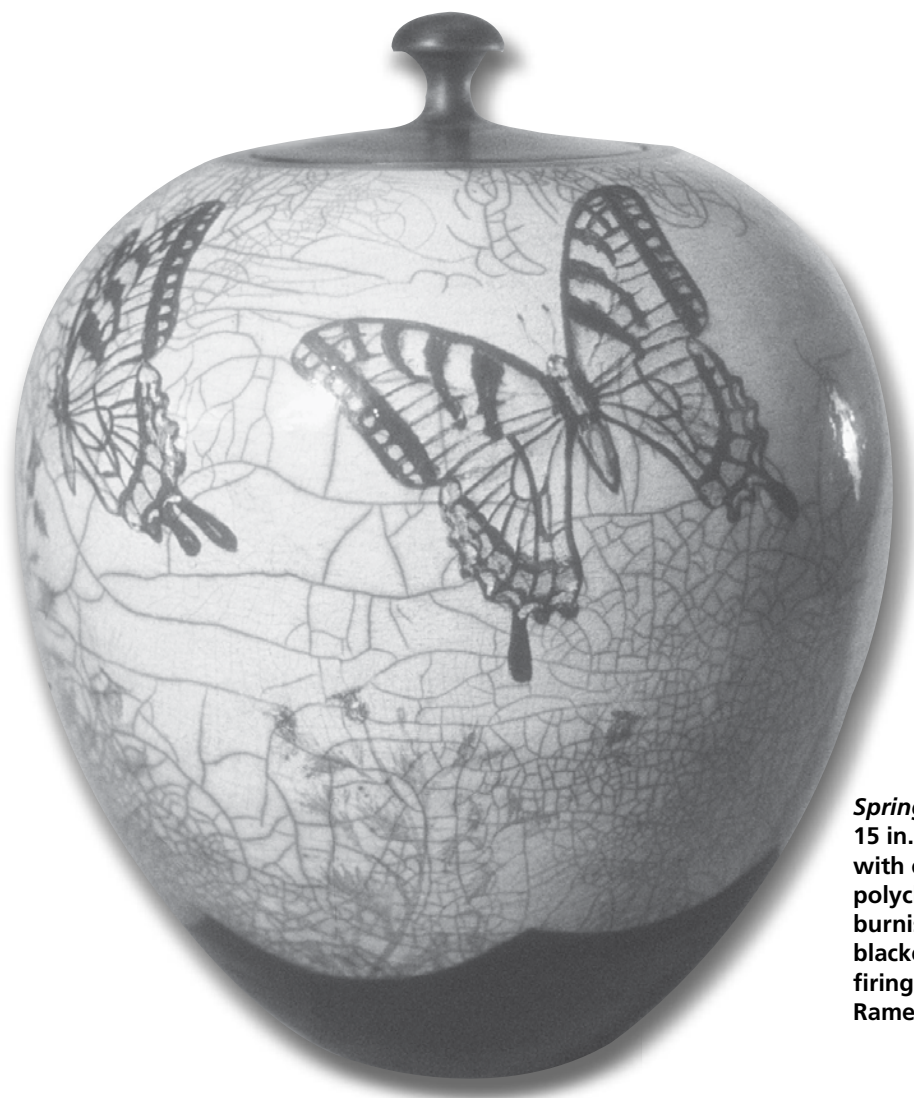
by Charlie and Linda Riggs

Naked Raku gets its name because an outer covering of slip falls off during firing leaving the naked clay body behind. Discover what's underneath by trying out Charlie and Linda Riggs' naked raku techniques.



How to Raku

by John Ramer Sherrill



Spring Swallowtails, 15 in. (38 cm) in height, with clear glaze over polychrome slips, and burnished lid carbon-blackened during post-firing reduction, by John Ramer Sherrill.

Raku pottery has become tremendously popular in the United States. The wide range of glazing and firing methods, and the surprises that lurk in every firing hold the interest of potters year after year.

Many achieve consistent results, but I've talked to dozens of established potters as well as students who have been unhappy with their raku attempts. Most complained that they had been unable to find specific information to properly guide them in their efforts.

For my own early efforts, I obtained several books on the subject, but found them frustratingly long on philosophy and short on technique. I still couldn't properly fire a raku pot, but I could use my new-found knowledge of Zen to cope with the situation. I don't believe there are many raku enthusiasts who are interested in my philoso-

phy, wondrous as it may be, but I know for certain that some want to know how to do raku.

Select a Raku Clay

A wide variety of clays can be used to make raku pottery. Be aware, though, that the clay used determines much of the character of the finished piece.

Most suppliers sell a body designated as "raku" clay, which is usually a grogged clay that includes Kyanite. It is the clay of choice for really massive raku pieces. Suppliers also usually have bodies that are designated as "ovenware" clay. These clays, which contain less grog (easier on the hands), often make an ideal raku body. I use ovenware clay almost exclusively.

For more information, see "Raku Pottery Clay" on page 5.

Form and Dry Raku Pieces

Raku pots are usually wheelthrown or handbuilt. I've heard from several sources that cast pieces cannot be raku fired, but I've never had a problem with them although you'll need to test them.

Some consideration needs to be given to proper drying. As a general rule, drying pots of 3 pounds or less does not require special handling. I often force dry and bisque fire the same day. Flat pieces and large pots must be dried slowly and evenly, though. Large ovenware pots will often survive fast drying, but the stresses that are thereby induced will cause them to crack at a later stage.

Decorate with Slips

If you want a colorful pot, you may use oxides or stains in the glaze, but they may mask the dark crackles to some degree; some almost entirely obliterate them. For that reason, I use colored slips under a clear glaze. My slip base is simple—1 part ball clay to 1 part EPK kaolin. Just mix it with water to a cream consistency and add stain. I use commercial stains in percentages ranging from 2% (dark blue and green stains) to as much as 30% (pink stains).

In order to choose the stains that will work well, it is good to know their chemical components. Most commercial stains will block carbon to some extent, with the worst offenders being those that contain iron or vanadium. Vanadium is present in most warm-tone commercial stains, so you should use titanium yellow, praseodymium yellow or zirconium yellow in combination with other vanadium-free stains to formulate your own palette.

Ideally, the slip should be brushed or dipped on at the leather-hard stage, but it works on bisqueware as well. When brushing, you should apply three coats for dark colors (when you don't want the body showing through) and two coats for lighter colors (a warm-tone body showing through some, such as pale green, can be very attractive). The pot should then be bisque fired in the cone 08 to cone 04 range.

Glaze Raku Ware

After bisquing, the pot is ready for glazing and the final firing. Glaze should be applied fairly thickly. If you dip, the consistency should be about that of thick cream, and one dipping should suffice. If you brush, the glaze should be somewhat thicker, and two or three coats should be applied. Evenness of application is not particularly important.

It is somewhat traditional to leave the area near the base unglazed. This will turn quite black in a good post-firing reduction, when carbon penetrates the still-hot pot. Other areas may be left unglazed as well. These areas may be random or symmetrical, and can greatly enhance the beauty of the finished piece.



Webbed Jar, 14 inches high, wheel-thrown ovenware clay, raku fired; blackened areas were taped to resist the glaze.

Select a Raku Kiln

Because red-hot pots are removed from the kiln, it is apparent that many models simply are not appropriate for raku firing. Large kilns of any type, when opened at temperature, radiate heat so fiercely that it would be foolhardy to attempt raku firing. Top-loading kilns are not ideal since you must position yourself above the kiln in order to reach inside, and the rising heat can be overpowering.

Small (2 cubic feet or less) front-loading electric kilns may be used, but most raku firing is done in gas kilns especially constructed for that purpose. See “Buying a Raku Kiln” page 8.

Fire a Raku Kiln

Raku kilns, unlike conventional kilns, are usually loaded on a single level, and spaces between pots are left a bit wider in order to facilitate their removal. It is certainly possible to use multiple levels, but it isn't worth the hassle, as far as I am concerned.

Traditionally, the maturity of the glaze is determined visually. The kiln is opened, and the pot surfaces are examined for complete glaze melt. If mature, the glazes will appear wet and reflective. I strongly recommend using a pyrometer in conjunction with this technique, noting the temperature at which maturation occurs. After a few

firings, you will need to look only at the pyrometer to determine unloading time. There is some medical evidence that prolonged or repeated staring into a red-hot kiln can damage vision.

When examining the pot for complete glaze melt, look for bubbles in the glaze, as these can mar an otherwise perfect pot. Even if the bubbles burst when the kiln is opened, unsightly craters will remain. Bubbles are almost always present on my pots because I fire rapidly, so I simply assume their presence, and take steps to remove them.

To accomplish this, partially open the kiln just long enough to drop the temperature by 200°F or so (I give it about a 10-second count). Close the kiln and bring the temperature back up to near maturity. Give it a couple of minutes for the craters to heal. If you have clusters of bubbles, you may have to repeat the procedure.

Post-firing Reduction in Raku Firing

The final phase of raku firing requires the still-hot pot to be placed in combustible materials inside a fireproof receptacle that can be covered, the tighter the better. The combustible material can be sawdust, straw, leaves, newspapers or anything else that readily catches fire. I prefer a bed of sawdust covered with crumpled newspapers, but I suggest trying different materials to discover what best suits you. See “Finding the Right Combustibles for Raku Firing” on page 16. In any case, the bed of combustibles should be prepared in advance of the firing.

Post-firing reduction is where the novice usually runs into problems. It is potentially a dangerous process, so always take precautions and exercise extreme care. You will be working closely with temperatures up to 1800°F, so you must train yourself to touch nothing without first considering whether or not it may be hot. After a long raking session, I actually catch myself hesitating before entering my home, considering whether or not the doorknob is hot. It is a useful habit to cultivate.

Cover as much of your body as possible (always wear long sleeves), but don't wear polyester. Taste in clothing is not the problem; the problem is polyester will melt and conform to your body like hot glue. Heat-resistant gloves are a must.

A hat and face mask are not absolutely necessary, but are a good idea. I prefer to remove large pots by hand, but for this, special heat-resistant insulated gloves must be used. For smaller pots, long metal tongs are suitable.

Reduction techniques vary quite a lot, so I will simply describe my own; modify as you wish. I remove the pot and place it on a fire proof surface, then wait for cracks to appear in the glaze on the rapidly cooling surface. In bright sunshine, these cracks generally appear as shiny lines. They will announce their appearance with audible pings or pops.

Only then do I place the pot into the reduction receptacle. This action takes place for a small pot, such as a bud vase, in as little as 10 seconds. A very large vessel (5 pounds and up) may require 90 seconds or even longer. This timing from kiln to post-firing reduction is very important, as it will, in large part, determine what kind of crackle effect will be achieved. I find that the sequence I have described gives deep, dark, widely-spaced crackles usually interspersed with networks of finer lines. Varying the timing should soon show you how to get the effect you prefer.

How to Quench a Raku Pot

A lot of pots are lost in the raku step called “quenching.” After reducing for a minute or more, the pot is removed with tongs and submerged immediately in a container of water. The water hisses and bubbles, and the hot pot rolls about as if in pain. Those with narrow mouths will gyrate wildly, and will sometimes rocket themselves clear out of the container. All this commotion by a suddenly animated pot is undeniably a lot of fun, but I no longer enjoy it because I no longer do it.

These days, I just leave small pots in the tightly covered reduction chamber for about 5 minutes, remove them and place them on the ground to cool. I leave large pots in reduction for up to 30 minutes, long enough for them to drop below the quartz-inversion temperature (1063°F), because that is when a large exposed pot is in serious danger of cracking. As far as I've been able to determine, the only thing I lose by not quenching pots are pots and, yes, a bit of fun.

After the pot cools enough to handle, all that remains is to scrub it vigorously with a metal pad or wire brush.

recipes

The following gloss glazes are dependable and work well with underglazes and colored slips.

Clear Raku Glaze

Cone 06

Gerstley Borate	70 %
Plastic Vitrox Clay	<u>30</u>
	100 %

Translucent White Raku Glaze

Cone 08

Gerstley Borate	80 %
Cornwall Stone	<u>20</u>
	100 %

Clear to Cloudy Raku Glaze

Cone 08

Gerstley Borate	75 %
Feldspar (Soda or Potash)	<u>25</u>
	100 %

Raku Clay

by Bill Jones

The raku firing process requires a porous nonvitrified clay that can withstand rapid heating to low-fire temperatures (approximately 1700°–1950°F) and rapid cooling without cracking or breaking from the thermal shock. By this definition, any clay that can withstand such stresses can be considered a raku clay; however, some clays will provide a greater degree of success, especially those with a high fireclay content. It's important to recognize that when deciding on a suitable raku clay, your chances for success increase with bodies specifically formulated or adjusted for the raku process.

Additions

Most clay bodies can be used for raku by adding up to 50% grog. Grog, which is crushed, fired clay, opens the body thus making it less prone to thermal shock. Other materials you can add to increase the ability of a body to withstand thermal shock include silica sand and kyanite. Silica sand can be used as a substitute for grog, especially at the lower raku temperatures. Because it's not as absorbent as grog, you may recognize some gains in plasticity. Kyanite is a refractory material that matures at about cone 36. One of the characteristics of kyanite is that it expands when heated, which counteracts some clay shrinkage. It also creates a network of needle-like crystals allowing you to make larger forms. Commercial raku clay bodies contain one or a combination of these ingredients depending on other qualities you need in a body, such as the ability to make large work, or whether you're throwing or handbuilding. You can add any of these materials to an existing body simply by wedging them in. Using a pug mill or clay mixer provides a more homogenous mix, and dry batching provides a more consistent mix.

Bisque Firing

Most raku clays can be fired as high as cone 6–10 since they are formulated as stoneware clays. But clay is clay and it should be noted that when bisque firing for raku, you should not bisque fire higher than cone 04 (1950°F).

Between approximately 2000°F and 2200°F the material becomes more dense and glasslike, thereby losing some of its ability to withstand thermal shock.

Tips for Buying Raku Clay

Most clay suppliers offer a range of raku clay bodies that can usually match the qualities you're familiar with in your regular body. They will be able to guide you either through their product descriptions or in consultation, and many clay producers will even custom blend a clay from your own recipe.

Plasticity: Clays with coarser grog are more suitable for handbuilding, while finer grog makes a better throwing clay. Some commercial clays are suitable for both.

Thermal shock: The larger and thicker the pieces, the more suitable and shock resistant the clay has to be. Increasing the shock resistance means adding more nonplastic refractory material, which may decrease plasticity.

Color: The color of the raku clay body influences the colors of your glazes. Light-colored or buff bodies produce lighter, more brilliant glaze colors and bring out subtle shades, while darker clay bodies have a more muting affect. Raku clays made from buff stoneware, kaolins and ball clays produce lighter colors, while adding earthenware clays and colorants like iron oxide or burnt umber will create darker bodies.

Texture: Adding grog to a clay body affects the texture since the grog is already fired and does not shrink. While this is not much of a factor with fine or medium grog, it is more noticeable with coarse grog. If you're looking for smooth texture, you'll want a body with fine grog, sand or kyanite. You can also create unusual textures by wedging in sawdust or paper pulp, which also opens the body and increases resistance to thermal shock.

As with any clay or glaze, you should test a raku body before you invest a sizeable amount of energy in forming work. Many suppliers offer samples that you can test, or you can try out different additions to your existing body. Mark all of your samples and keep good records of your results.

Raku Glazes

by Steven Branfman



Sprayed stoneware glaze under clear raku glaze, by Steven Branfman.

In my workshops, I get asked many questions but never “What is a raku glaze?” Why? Because everyone knows what a raku glaze is. Right? It’s a glaze that is labeled “raku.” Wrong. It’s time to expand your thinking and understand exactly what this whole raku glaze thing is about.

A raku glaze is any glaze you use in the raku method. It doesn’t have to be a glaze specifically designed for raku, formulated to fire at the temperature you fire your raku to, nor homemade or commercial. It can be most anything. The key to success is understanding the raku firing process and the ability to predict how a particular glaze reacts to that process.

Raku, as practiced in the West, is a low-fire method in which we quickly heat the ware, remove the ware from the kiln when the glaze has melted, and perform some type of post-firing process to the piece. The post-firing phase is usually an immersion in an organic combustible material to affect the final outcome on the glaze and the

raw clay. Deciding when the glaze has melted takes practice and is best done by observation, though many potters use pyrometers to aid in making that decision. Raku is exciting, often unpredictable to the novice, and fun to do.

Applying Raku Glaze

Glazing work for raku can be done by all the methods known—dipping, pouring, brushing, spraying, splashing, dripping, sponging—you name it. Glazes also can be used alone or in combination. Keep in mind that the application of a glaze has a direct effect on the result.

Dedicated Raku Glazes

Glazes specifically designed for raku fall into two categories—homemade and commercially prepared. If you mix your own, you’ll find scores of recipes. Search the internet, ask friends, look in any book on glazes or raku, and look in magazines. In no time you will find more glazes than you could use in a lifetime. Of course, to mix your



Multi-layered, brushed, commercial low-fire glazes.

own glazes you must have a stock of materials, mixing paraphernalia, knowledge, and interest. If this doesn't turn you on there are myriad manufacturers that produce almost as many raku glazes. The advantage of using commercial glazes is that you are given instruction on how to use the glaze, you have a sample of the fired glaze to help guide your results, and the formulation (although not the results!) will be consistent time after time. Of course, commercial glazes are a bit more expensive than mixing your own.

Low-Fire Glazes for Raku Firing

Glazes used in the raku process need not be “raku” glazes at all. At its core, raku is a low-temperature firing method. The fact that we remove the ware from the kiln while the pots are hot and the glaze is molten is irrelevant. Understanding this opens up a whole new world of glazes. Any glaze that's formulated to fire at the low temperature of raku can be used. First, you must decide at what temperature you are firing. Most raku is done in the cone 010–06 range. Begin by choosing glazes that both appeal to you in color and that fire in your range. You will have to experiment but I have never found a glaze that I couldn't use successfully.

High-Fire Glazes for Raku Firing

We are not limited only to glazes that melt at the low temperatures. With greater understanding of the raku process, even mid-range and high-fire glazes can be used in the low-temperature range of raku. Try using your regular



Brushed stoneware glaze under clear raku glaze.

stoneware glazes as slips. Over the glaze, apply a clear or white raku or other low-temperature glaze. The low-temperature glaze causes the high-fire glaze to melt giving you a new palette of colors to work with.

Other Glazes for Raku Pottery

In addition to glazes, slips, engobes, underglazes, overglazes, china paints, underglaze pencils, oxides, and stains are all viable in the raku process.

Raku Pottery Food Safety

No matter what type of glaze or decorative material you use, raku is inherently unsafe for use as domestic ware. The rapid firing, removal of the ware, and subsequent post-firing phase all contribute to fragility, porosity, and thin, easily flaked glaze surfaces. Not all materials used in raku glazes are toxic. In fact, most are not. Confusion arises when you realize that over the centuries some of the most prized teabowls by tea masters have been raku fired. Be safe, and think of your raku ware as decorative and not functional.

Buying a Raku Kiln

by Steven Branfman



Unloading a top-hat raku kiln.

Raku firing is expressive, exciting, and fun. Whether you're raku firing in your own studio, or taking part in a group firing at a school, workshop or community center, raku offers many rewards. But the process requires more than just enthusiasm; you need the proper equipment and tools to make the event successful. If you're interested in getting started with raku or in adding raku to your program, here are a few pointers for getting off to a good start with the right kiln—the most important tool you'll need.

The Basic Raku Process

With raku you begin by placing your work in a cold kiln and bringing it up to temperature, approximately 1800–1900°F. The rate at which you attain this temperature is based on a variety of factors: size of the work, size and type of kiln, burner output, etc. A raku session usually consists of firing more than one load, so the ability to pre-heat the waiting work, unload the hot ware safely, reload, and then reheat the kiln all need to be considered. The choice of fuel—natural gas, wood, electric or propane—is important because each of these carries limitations as well as benefits. You'll need to consider the physical location of the kiln so that it can be placed with ample space around it for safety and space to work. And finally,

consider whether you'll be firing alone, with an assistant, or with a group.

Configurations

There are many configurations for raku kilns—top loaders, front loaders, top hats, car kilns, and clam shells. Some top hats have pulley systems, springs, counter weights, and guiding tracks to raise and lower the chamber. Without the lifting mechanism, a large top-hat kiln requires two people to safely lift the body off, while smaller kilns require only one person. After gaining experience, most raku potters gravitate to one specific style and design. The important thing with any kiln is that you are comfortable with its workings. It must accommodate your work. It must be possible to safely open the extremely hot kiln, remove the contents, reload, and close it up again losing as little heat as possible. Before buying or building a kiln, do as much observation, participation, and research as possible.

Temperature

Even though most raku firing takes place in the cone 010–04 range some of the kilns on the market are rated for higher temperatures—up to cone 10. While some kilns are designed specifically for raku, others were originally de-

signed as stoneware kilns that can be used for raku or were modified for raku. You'll need to check with manufacturers about the full capabilities of their kilns.

Fuel

Raku kilns can be fired with natural gas, wood, propane or electric (see page 36). If using propane, you'll need to purchase or rent a tank. While a 20 lb. tank works on warm days or with smaller kilns, it is recommended that you get a larger, refillable tank, or purchase two or three smaller tanks and gang them together with the appropriate connectors. You can take 30, 40, 60, 70, and even 100 pound tanks in for refilling. With propane, more surface area in the tanks means more gas will be produced assuring a steady supply. This is especially important as you get into larger kilns with bigger burners. With natural gas, you are limited to the available pressure and location of a gas line, but there is some flexibility because you can lead a gas hose to the burner.

Burners

Burners are rated by their output, which is measured in Btu's (British thermal units). Natural gas and propane use different orifice sizes so you'll need to specify which kind of fuel you'll be using. Kiln manufacturers have done the engineering for their kilns and have matched the appropriate burner(s) with the unit, taking size, insulation, and temperature range into consideration. Many manufacturers also offer regulators, gauges, and safety features with their burner, which are described in their literature. If you're building your own kiln, instructions should include burner specifications. If not, consult with a burner supplier. Kiln size, construction materials and type of gas being used is all the information they will need.

Electric

While any electric kiln can be used for raku, there are some electric kilns on the market specifically designed for raku. Regardless, you'll need to either locate the kiln outside, or near an outside entrance so you can unload the kiln and quickly move your pieces outdoors for the subsequent post-firing phase. One hazard with using a standard electric kiln is that the power must be shut off before reaching into it with metal tongs to eliminate the possibility of accidentally touching a live element. Some electric kilns are built with a lifting mechanism, which raises the entire body of the kiln, including all the electrics, up and out of the way when loading and reloading.

The Do-It-Yourself Option

One option is to build a raku kiln from one of the many plans available in books and online. We have two plans on our website at www.potterymaking.org, one for a fiber-lined wire-frame design, and the other a small fiber-lined barrel. Another inexpensive option for the DIY route is to purchase a kit. Some kits, which include all the materials needed to

Raku Kiln Manufacturers

Axner	www.axner.com
Bracker's Good Earth Clays	www.brackers.com
Ceramic Services	www.ceramicservices.com
Clay Art Center	www.clayartcenter.net
L&R Specialties, Inc.	www.claydogs.com
Laguna	www.laguna.com
Mile Hi Ceramics, Inc. (Zen Kilns)	www.milehiceramics.com
Nabertherm	www.nabertherm.com
New Mexico Clay Co.	www.nmclay.com
Olympic Kilns	www.greatkilns.com
Seattle Pottery Supply	www.cruciblekilns.com
Sugar Creek Industries (Good Kilns)	www.sugarcreekind.com
Summit Kilns	www.swiftweb.com/summit
Ward Burner Systems	www.wardburner.com

not only build a kiln, but also essential extras like tongs, furniture, gloves, etc.

Safety

Raku is inherently a dangerous activity, but no more so than working around a bonfire. If you purchased a commercial kiln, you'll need to read, understand, and follow all safety instructions provided by the manufacturer because their warnings are based on experience and following them assures an accident-free experience. If building your own, be sure that you're comfortable and confident in your design and experience. The appropriate clothing, gloves, and eye protection are critical for protection against the kiln's heat for any of those handling the work, and in both solo and group situations, attention must be paid to the "choreography"—the dance—of the raku firing process. It is certainly not the time to be tripping over one another.

Cost

Many commercial raku kilns are priced under \$1000 with a few fetching more than \$2500 because of the need for higher end functionality. Building your own raku kiln from a kit or rounding up all the pieces and parts can lower your costs. It is similar to buying a computer or any other major appliance; determine what's in your budget and then look around, but don't forget to factor in tongs, gloves, goggles, shelves, and the other equipment you'll need. We've listed most of the manufacturers and their website, and several of these sell through distributors, which may be closer to home so you'll pay less for shipping.

Test Drive

If you haven't tried raku, but have always been fascinated by the spontaneity, immediacy and simplicity of the craft, by all means, sign up for a workshop. You'll be amazed at what a great activity this is and why it's one of the most popular clay studio techniques around, enjoyed by thousands of potters of all ages.

How to Make a Raku Mural

by Barbara VanSickle



"White Pines," 24 inches in height.

The idea of creating raku murals happened quite naturally. A few years ago I was fortunate enough to be asked to create a retirement gift for a dear friend and former colleague. I needed to design something very special. I knew that he was partial to raku surfaces. During visits to his home, I was struck by its impressive open-concept architecture with the tall, wide wall spaces. The more I thought about what to make, the clearer it became: a raku mural.

The problem was I had no idea on how to proceed. My experience with raku was limited and, although I had previously created some murals for a school installation with children, I'd never attempted anything like this. The

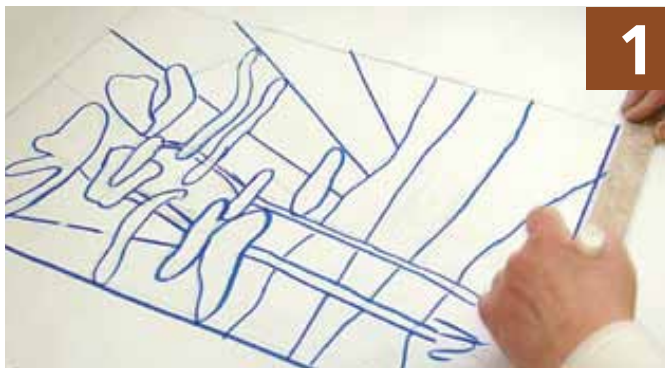
school project gave me some of the technical knowledge and experience of creating, drying and mounting the clay tiles but I needed inspiration for the subject matter.

I turned to my own environment and my love of Art Nouveau stained glass to come up with the design for "India Blue Peacock." Two doors down the road from me lives a family that raises India Blues. I hear the peacock calls all through the days from early spring to late fall. Linking the peacock with the Art Nouveau stained-glass look was quite natural.

Since making this first mural, I have continued to look to my own experiences and environment for inspiration.

Prepare Paper Template

Begin a mural by making a series of small drawings. Whatever your inspiration, remember that simplified edges work best (as in stained glass) and that some areas naturally lend themselves to being cut into sections. If you have areas that would be too large for one tile, plan how you'll adapt your work by adding divisions in the tiles that add to the overall design. Enlarge the drawing to actual size, then use a marker to highlight the lines. On larger projects, you'll need to cut your plan into smaller pieces. If so,



1



2



3



4

number each piece on the back to make it easier to reassemble later (*figure 1*).

Prepare the Slab

Roll out a slab to a thickness of approximately $\frac{3}{8}$ inch on a textured material, such as rubber shelf liner or placemats. The textured rubber material provides a perfect backing for the tile, which helps prevent warping during drying and firing. It also makes the slabs easy to carry without distorting (*figure 2*). Remove any unwanted marks with a rib and rolling pin, being sure to roll the slab no thinner than $\frac{1}{3}$ inch. Thinner tiles are more likely to warp during drying and firing (*figure 3*). Peel off the rubber backing, then join slabs together as needed (*figure 4*). Place the slabs on a flat surface, and cover it with plastic for about a day.

Transfer the Design

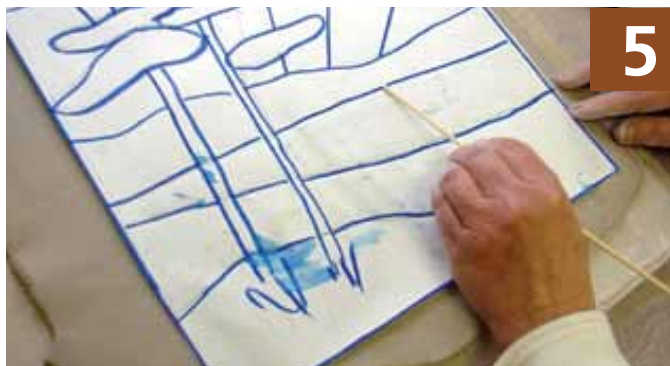
Lay the paper pattern on the slab, then using a blunt tool, such as the dull end of a wooden skewer, trace over the marker lines. When the template is removed, you will be able to use the incised lines as guides for adding any relief or textures. Trim the edges of your panel using a straightedge and a sharp, dry knife, then cut the panel into individual tiles (*figure 5*).

Create the Pieces

Arrange your cut tiles on a large board or table to form your mural and add any relief or impressed designs. Once you've completed all the additions, cut through any pieces that overlap from tile to tile. Clean up and smooth all edges.

Drying process

Cover the entire mural with plastic, and place sandbags strategi-



5



6



7



8



9



10

cally to keep the pieces as flat as possible during the drying phase. Tip: I make sandbags by cutting up old sheets into 12-inch squares, then scoop sand onto them, bring the edges up and fasten them with rubber bands. They are a great tool to have around the studio (*figure 6*). Check on the mural daily as warping can be reduced by relocating the sandbags if you catch it right away. Once leather hard, turn the tiles over and re-cover with plastic to allow them

to dry slowly (about a week in my studio). Remove the plastic, turn the tiles right side up, and give the work at least another day to dry before bisque firing.

Glazing

Reassemble all the pieces to form the mural before glazing. This makes it much easier to apply the glazes accurately. If you're masking any areas, apply your tape or resist material. I prefer to use black graphic tape as it provides



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excellent contrast, and can easily be rearranged without leaving residue on the bisqued tiles. It also creates perfectly straight lines (*figure 7*). Apply glazes according to your original drawings. I prefer to brush them on by completing all of one glaze color at a time on the entire mural before moving to the next glaze (*figure 8*).

Raku

I fire my mural pieces in a raku kiln (*figure 9*). Due to the extreme range of reduction effects that influence the glaze surface and color development, try to fire tiles that will be side by side in the mural in the same load. If possible place

them in the same reduction chamber together. Use a pyrometer and time each fire to get the greatest consistency between loads, and try to fire under the same conditions if your work will take longer than a day. This process takes considerable planning but the results are well worth the effort. If you get too much or too little reduction on a particular piece, remember that you can always refire.

Assemble the mural

Reassemble the mural (*figure 10*) and measure the finished height and width. This is the base measurement for your mounting board. Where and how your



***The Three Sisters*, 22 inches in height, raku fired, by Barbara Vansickle.**



***India Blue Peacock*, 48 inches in height.**

work is hung determines the type of material for mounting. If you're working on a project any larger than 8 square feet, use plywood. For smaller murals, I recommend $\frac{5}{8}$ -inch-thick medium density fiber board (MDF) as it is lighter, though on larger murals it can warp.

For a mural the size made here, mark the MDF board roughly three-fourths of the way up from the bottom edge and drill $\frac{1}{4}$ -inch holes 2 inches in from either side. Countersink the holes on the front of the board deep enough for a $\frac{1}{4}$ -inch nut to be flush with the face. Drill two large diameter washers to accept the hanging wire

and bend them slightly outward. Attach the washers to the back of the board through the $\frac{1}{4}$ -inch bolt head and tighten (*figure 11*).

Prime the MDF and, when thoroughly dry, apply paint (I prefer matt black). Allow the paint to dry completely for 24 hours, then spread a good quality construction glue to the mounting board, keeping it off anywhere that will show when done (*figure 12*). Beginning at the bottom, apply the glue to the back of the tiles, one or two at a time, and assemble. The glue dries very fast, so you'll need to work quickly (*figure 13*).

When it is completely dry (at least 8 hours), grout the mural. Remember in your planning that grout comes in many colors so it can further enhance the final project. Follow the manufacturer's instructions. Once the grout begins to thicken, pour it on the mural paying particular attention to the small spaces between each tile (*figure 14*). Gradually remove the extra grout using a damp sponge, changing the water frequently (*figure 15*). Allow to dry.

Thread heavy duty picture wire through the holes in the washers and adjust the length appropriately.

Testing Raku Combustibles

by Frank James Fisher



Raku firing dates back to sixteenth-century Japan. The Japanese tradition was based on an oxidized firing and cooling method. The introduction of a combustible reduction atmosphere is a recent North American development, and it's this process of doing something to a piece after it has been pulled from the fire that distinguishes Western raku from Japanese raku.

The most commonly used combustible for raku reduction is paper. I've used two types of paper—shredded office documents and shredded newspaper. My preference is newspaper because the colors in a luster glaze appear more intense and display greater color variety. This may be a result of the chemicals in the newspaper's printing inks.

Another common raku combustible is sawdust. Sawdust burns more like cinders in a fire, much slower than paper, and the areas of contact between the sawdust and the glaze surface often become speckled.

In considering other natural combustibles, such as leaves and grass clippings (two materials that I have too

much of in my yard), I wondered how these materials would affect glaze color and surface. A side-by-side test to measure the differences would be an interesting project.

How to Test Raku Combustibles

I began by throwing four similar spheres from white stoneware clay and bisque firing them. I selected Del Favero Luster as the glaze because it has a sensitive range of color depending on the post-firing reduction. I wiped each sphere with a damp sponge to remove any surface dust before glazing. Each sphere was dipped upside down to $\frac{1}{3}$ of its height into a well-mixed bucket of Del Favero glaze. When dry, I loaded an airbrush with Del Favero Luster and sprayed a transition band along the longitude of the sphere. Again, I kept the glaze well mixed by shaking the airbrush's reservoir during the application. The sphere surface had both a thick, dipped application and a thin, sprayed application. The bottom third of the sphere was left bare (see above). This would provide a comparison of the carbonization on the surface.



A glazed sphere before raku firing.

recipe

Del Favero Luster

Gerstley Borate	80	%
Cornwall Stone	20	
	<hr/>	100 %

Add: Copper Carbonate 2 %

Del Favero Luster settles very quickly, so it's important to remix this glaze preceding each dip.



Placing sphere into a can of combustibles.

With the glaze thoroughly dry, the four spheres were loaded into the raku kiln and fired to 1800°F. When the glazed surface on the spheres appeared glassy, the kiln was turned off, the lid was removed, and, in quick succession, each sphere was rapidly pulled and placed into four separate, but identical, galvanized trashcans. Three cans were filled ⅓ full with newspaper, grass clippings, and leaves respectively, and a fourth can was filled half full of sawdust since the density of sawdust prevents the sphere from submerging into the combustible.

When each combustible burst into flames, we waited 10 seconds before sealing the can with the lid. The sawdust sphere also received a coating of sawdust to cover the top surface before the lid was sealed. The lids were reasonably tight and very little smoke escaped. We did not 'burp' the lid during reduction to re-ignite the combustibles. After an hour, the spheres had cooled down and each was removed. Under warm tap water, the surfaces were rinsed of any clinging, blackened combustible without scrubbing with a cleanser. After drying for a week, the four spheres

were given a thin coat of sealer to bring out the blacks on the bare clay surface.

Ratings of Raku Combustibles

To say the least, I was shocked. The two main variables were the spontaneity of the combustible material and the amount of oxygen hidden within the layers of combustible. Both of these variables affected the strength of reduction occurring in each can.

Each sphere exhibited a very distinct look. If I hadn't experienced the test myself, I wouldn't have believed the variety of color in the results. The difference between the newspaper, the leaves, and the sawdust was very dramatic. The grass clippings appeared to be a visual blend of the results seen using newspaper and leaves. The carbonization on the bare surfaces was virtually identical on all four spheres.

When I raku, newspaper remains my combustible of choice with an occasional handful of sawdust for added texture just before the can lid is sealed.



Shredded Newspaper

I understand why newspaper is a preferred combustible choice—very strong reduction. Paper burns rapidly upon contact with the fired clay surface. The quicker ignition removes the oxygen rapidly from the air providing a strong reduction atmosphere. Less oxygen results in flashes of red from the copper in the glaze. Paper is a flexible material and compresses easily allowing a lot of paper to be packed into a can for a maximum oxygen burn-off. The paper left minimal markings on the final glaze surface. The surface showed no discernible difference between the thick and thin applications of glaze, and nearly all the paper that was in the can was ignited.

Sawdust

The sawdust sphere had a very strong reduction and an interesting speckled texture on the glaze surface. Each dot of black represented burned sawdust. The sphere was buried half-way into the sawdust. The upper surface was then covered with additional sawdust leaving no exposed glaze surface to receive oxygen. Had the surface of the glaze been exposed to oxygen, a very different outcome would have resulted. The surface showed no discernible difference between the thick and thin applications of glaze. The sawdust in the can that came in contact with the sphere surface ignited while the remaining sawdust was virtually untouched. A stiff brush was needed to dislodge the cindered sawdust from the glaze surface.

Dry Leaves

The leaves had minimal effect on reduction. The dry leaves were stiff and did not compress as readily as the newspaper, and there were pockets of oxygen, more than the other combustibles tested. During reduction, the availability of oxygen caused the copper to turn green. The leaves did not burst into flames with the same intensity as the newspaper; instead, it was more of a gradual build, igniting approximately half of the leaves. Leaves are similar to paper regarding surface contact—virtually no affect on the glazed surface. The glaze displayed a green mottling on the thick application but not on the thin application. Slight reduction occurred near the bottom of the sphere on the glazed areas. This is a result of the weight of the sphere pressing into the leaves and smothering out the oxygen.

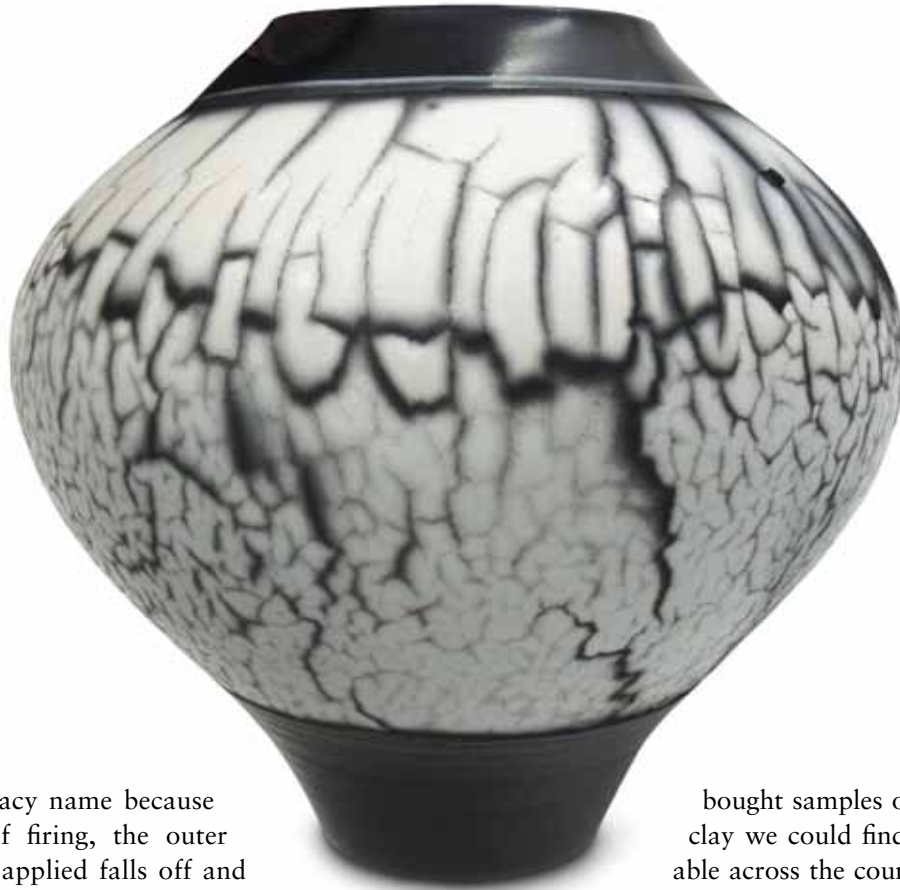
Grass Clippings

The can filled with grass clippings provided a varied reduction. Some of the surface had a smoky bronze coloring and other areas had a green/white surface similar to the leaves. The grass clippings were reasonably dry, but did not ignite readily like the newspaper. It was more of a slow, smoldering burn with flames clearly visible, igniting approximately half of the grass clippings. Because the grass clippings did not burn readily, oxygen was not quickly consumed. The smoke was very heavy and thick, and may have contributed to the vertical areas of dark reduction up the side of the sphere. The glaze surface displayed a distinct green mottling on the thick glaze application but not on the thin application. The burning grass left a few black dashes on the glaze surface.



Pop Goes the Slip

by Linda and Charlie Riggs



Naked raku gets its racy name because during the process of firing, the outer shell of slip that was applied falls off and the surface of the pot returns to the original clay exterior. The pot is then “naked,” without a covering of glaze, whereas in a standard raku firing, a potter applies glaze to the pot and fires it to the desired temperature. The glaze matures on the pot and becomes part of the pot as a decorative surface.

Like Dry Cracked Mud

We use a method of naked raku that employs a very thick slip that is applied to the surface of a pot. When it dries, it shrinks and crackles like mud does on the side of a road. The vessel is fired to 1450°F, then carefully removed from the kiln and placed into a metal can lined with newspaper. Then the can is sealed with a tight-fitting lid. This infuses the pot with smoke. The thick slip resists the smoke so that the pot surface remains white underneath it. The crackles in the slip allow the smoke to reach the surface of the pot. When the pot is finished and the slip is removed, you have a pot with a beautiful black crackle surface.

This technique requires persistence and patience. It takes practice to remove the pot from the kiln without knocking off the slip. The slip itself requires slight adjustments to the amount of alumina. It is also important to use the right type of fire clay in your slip. To find a slip that works for us, we

bought samples of all of the types of fire clay we could find that were easily available across the country. We found one that worked very well, Hawthorne, but then later, through serendipity, made a batch with Lincoln

fire clay and it stayed on the pot even more reliably during the raku process. The final recipe we arrived at is measured by volume: 5 parts Lincoln fire clay, 3 parts EPK kaolin, and 2 parts alumina hydrate. Mix this up with water into a thick slip.

The Process

Mix the dry ingredients with water until you get a consistency of thick cake batter (*figure 1*). Add more alumina hydrate if the slip doesn't stick well to the pot during the raku process and subtract it from the recipe if the slip is difficult to remove from the surface after firing.

Mask off the areas you want to remain black using house painter's tape (*figure 2*). This tape is less sticky than regular masking tape and is less likely to harm the surface of your pot.

To get a pot with uniform crackles, lower it down into the slip and remove it all in one uniform movement (*figure 3*).

Carefully remove the tape, taking care not to get any slip on the areas that you want to remain black (*figure 4*). This slip is very sticky at this stage and is difficult to wipe off without leaving residual clay marks on the pot.



1
Mix the dry ingredients with water until a cake batter-like consistency is achieved. Add more alumina hydrate as needed.



2
Mask off the areas you want to remain black using house painter's tape.



3
To get a pot with uniform crackles, lower it down into the slip and remove it in one uniform movement.



4
Carefully, but quickly, remove the tape, taking care not to get any slip on the areas that you want to remain black.



5
Within first 2-5 minutes after applying the slip, put the pot immediately into your raku kiln. Don't allow it to dry at all.



6
While the pot is in the kiln, line a steel can that is slightly larger than the pot with several sheets of newspaper.



7 After the kiln reaches 1450°F, remove the pot with raku tongs and place it in the metal can reduction chamber.



8 Allow the pot to cool in the can for about 10 minutes. Open the lid, allow the smoke to clear and look in. The slip will be black.



9 The slip may fall off as you remove it from the can or you may need to wait until you can remove the slip using your fingers.



10 Remove excess slip and dust from the pot with a plastic scraper, or an old credit card.

Immediately put the pot into your raku kiln (*figure 5*). This means within first 2–5 minutes after applying the slip. Don't allow any drying at all. Fire the kiln quickly to 400–500°F and soak at that temperature until the slips loses all its moisture and begins to crackle (about 15 minutes). It will turn a dull gray and no longer have a shine on the surface. Then fire the pot up to 1450°F.

While the pot is in the kiln, line a steel can that is slightly larger than the pot with a several sheets of newspaper (*figure 6*). This size of container lessens the air space during the smoking process, which will force more carbon/smoke into the slip crackles on the pot.

At 1450°F (*figure 7*), use raku tongs to quickly and carefully remove the pot and place it in the metal can reduction chamber that's been prepared for it. Place some newspaper on top of the pot before closing the can. This enhances the blackening of the piece from the top down.

Allow it to cool in the can for about 10 minutes. Open the lid, allow the smoke to clear, and look in. The slip will be black (*figure 8*). Wearing raku/welders gloves, lift the pot out. **Note:** The piece may still be very hot, so use caution when handling it, even when wearing gloves. Place it on a kiln shelf, fire brick, or other non-flammable surface to cool. The slip will either fall off as you remove it from the can or you will need to wait until it cools so you can gently remove the slip using your fingers (*figure 9*). Remove excess slip and dust from the pot with a plastic scraper, or an old credit card (*figure 10*). Rub the rest of the dust off with a terry cloth towel. The cleaned pot is ready to seal with wax or an acrylic sealant.

Linda and Charlie Riggs are featured in the new Naked Raku and Related Bare Clay Techniques book by Eduardo Lazo. Visit ceramicartsdaily.org/bookstore for more information.