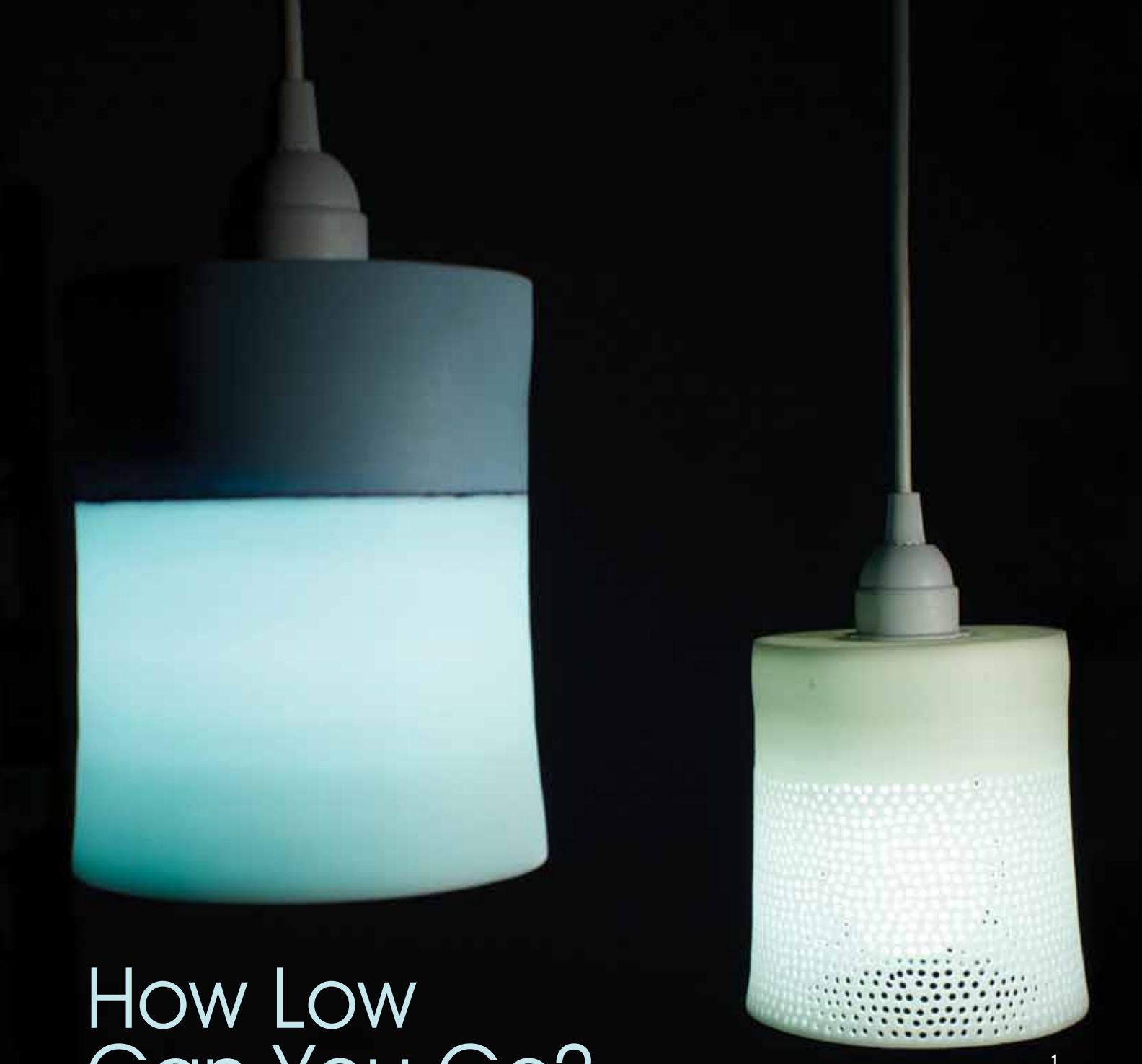


How Low Can You Go?

by Bryan Hopkins

1

Porcelain. Translucent. Vitrified. Self-glazing. Electric-fired. Cone 04. If this was a story being told in a movie, the sound you would have just heard is the needle scratching across the record as everything came to a standstill. Yet the material described above exists.

I have worked in porcelain for almost 25 years, and for the past 14 years I have worked in porcelain exclusively. I have always been dogmatic in my thinking of and my studio practice in porcelain: kaolin must be the only clay component, and as few other ingredients as possible to make a workable clay body. It then needs to be fired to at least cone 10 and be white, vitrified, and translucent where thin. The clay body I currently use in my daily studio production is a body I developed, and is whiter and more translucent than anything I know to be commercially available—yes, I am a porcelain snob.

On a trip to the Corning Museum of Glass in 2010, I became obsessed with what is known as the "casserole tower" (8). This glass-ceramic piece goes from clear glass at the bottom to opaque white at the top. I mistakenly thought it was a change in the clay

content that brought opacity to the iconic Corning White Casserole, and that mis-assumption, along with a ten-minute Google search, led me to my first test of a new (for me) clay body. It turns out the opacity shift results from a firing process first discovered when an annealing kiln at the Corning factory mis-fired when they were making nose cones for missiles in the 1950s. Over the past 18 months I have embarked upon a journey and have arrived in a strange new world of cone 04 electric firing. For someone who has been making porcelain work for more than 25 years in a purist, gas-reduction fired way, I think I know how Dorothy felt when she awoke in Oz.

An Extremely Brief History of Low-Temperature, Soft-Paste Porcelain

Soft-paste porcelain was first made as an attempt to imitate the porcelain wares being imported from China into Europe in the 1500s—the Medici factory in Italy did it first, somewhere around 1575. Soft-paste porcelain has a few different definitions and physical characteristics, but I will use the widely recognized one, of pastes produced by combining clay and powdered glass, for demonstration. Works made from this combination of materials are called *frittenporzellan* in Germany and *frita* in Spain. In France they are known as *pâte tendre* and in England as *soft-paste*. They appear to have been given this name in England because they do not easily retain their shape in the wet state, they tend to slump in the kiln under high temperatures, or the body and the glaze are easily scratched.[1]

A Contemporary Version

The clay body I have come up with is similar to the above definition of soft-paste porcelain, but its physical attributes are too far removed to be considered true soft paste. I am able to throw my clay body on the potter's wheel with no more difficulty than my cone 10 porcelain body, and it warps no more than the cone 10 body. My clay body does not need to be glazed, as it is fully vitrified, and the surface cannot be easily scratched. It has no absorption of water, is impervious to staining, and is unaffected by rapid heating (submerging in boiling water). So the question arises as what to call this low-fired body. It is much too dense and glass-like to call soft paste, so I propose the simple term "low-fire porcelain," due to the only difference between the finished pieces of cone 10 and cone 04: the firing temperature.

I set specific parameters for my initial research of low-fire porcelain. The clay had to be:

- translucent
- white
- vitrified
- fired in an electric kiln
- fired to as low a temperature as possible

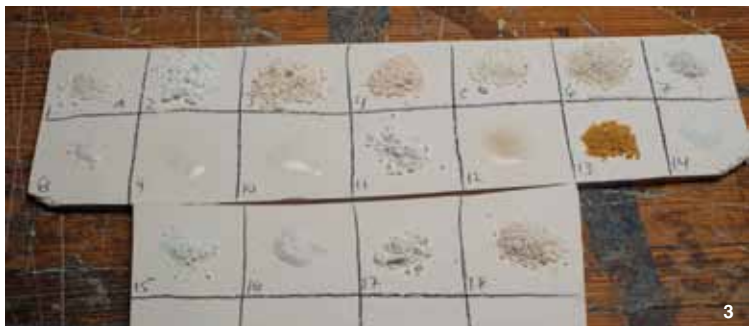
My experiments began with compiling every published recipe I could find for low-fired translucent clays, and mixed each one. None, and I do mean none, of them worked (2). Then I stepped back a little and did melt tests of every dry material I had in my studio at my bisque-firing temperature of cone 05 (3). These tests (of clays, fluxes, frits, and silica) revealed to what degree each material melted, as well as the fired color of the non-melting components of typical clay bodies, and those melt tests and color results revealed what needed to be cut back on or replaced in a final recipe.

As the testing progressed I set additional parameters, such as:

- no glaze
- single fired as quickly as possible
- primary forming method is throwing on the potter's wheel

Through my testing, I have made over 60 different samples of low-fired clay bodies. My final recipes are for two clay bodies, one


2


3

1 Bryan Hopkins' pendant lights, 7½ in. (19 cm) each, low-fire porcelain, stains, fired to cone 04 in an electric kiln, 2014. **2** Failed tests and melted pieces in the electric kiln. **3** Material tests of various raw chemicals, fired to cone 05 in an electric kiln.

4 Bryan Hopkins' *Spliced Cup*, 7 in. (18 cm) in height, low-fire porcelain, stains, fired to cone 04 in an electric kiln, 2014. **5** Bryan Hopkins' translucent, low-fire porcelain, fired to cone 04 in an electric kiln, 2014. **6** 18 months of low-fire porcelain tests. **7** Bryan Hopkins' cup set, up to 6¼ in. (16 cm), low-fire porcelain, stains, fired to cone 04 in an electric kiln, concrete base, 2014.

having a matte surface, the other a high-gloss surface. Both clays are single-fired to cone 04 on a 4-hour cycle, with a 30-minute hold at the end. As I mentioned, the clay is self glazing, and I do not put on any additional glaze (4–5).

Practical Applications

My interest in developing this clay body is going toward making colored clay using ceramic stains (6), and making work influenced by Color Field painting, for illuminated lighting fixtures (1).

I am not the only one doing research into low-fire porcelain. In the fall of 2012 I heard about a guy in Canada, named Aaron Nelson, who was doing work with a low-fired translucent clay, so I emailed him. He has been working with this material since about 2009. He uses a press-mold forming method to create elaborate sculptural pieces (9–10). Also finding an application for this material is US-based ceramic artist, Justin Rothshank. Because his material does not need a glaze, Justin is able to fire his pieces only twice (a firing for vitrification and a decal firing), which cuts his firings (and thus his electric bill) in half (11).

Energy Conscious

In Buffalo, New York, we are able to choose the company that we buy electric from. This allows a potter to fire an electric kiln using electricity produced by renewable resources, like solar, wind, or hydro power. This, to me, although potentially significant, was not a major part of my research, but I think it could be for someone who wants to cut energy consumption and lower their carbon footprint via lower firing temperatures and choosing cleaner energy sources. Also, I am a cyclist, and know how many watts I produce on an indoor trainer. That energy can be captured and stored, and if you fire a kiln using that harnessed power, that would be another "green" addition to your production.

Tips for Exploring Low-Fire porcelain

Based on my experience with historical recipes, I have found that recipes were only useful as a general guide to the types of materials to use. The specific combination will depend on material availability, geographic location, water, kiln firing cycles, etc. in each person's studio. Because I was unable to produce reliable results with someone else's recipe, I am not providing a specific recipe here, as it probably won't work in other studios with all of the variables listed above. That said, if you are curious, here are some tips to get you started on your investigation to find a recipe that works in your studio:

- Read up on soft-paste porcelain. I suggest; *Artificial Soft Paste Porcelain: France, Italy, Spain, and England*, by Edwin Barber, *The Art of Ceramics: European Ceramic Design 1500–1830*, by Howard Coutts, and John Gibbons "Identifying China by its Paste." *Collectors Weekly*, April 2010.
- Compile as many dry ingredients needed to make a clay body (clays, fluxes/frits, fillers) as you have access to and do low-fire melt tests (see figure 3) of your materials to find out how they behave and change. This will also give you a good indication of the fired color of a clay body made from different materials.
- Decide on simple line blends of a few ingredients as necessary to make a clay. Start with a simple ratio of half clay(s) (any white burning clays) and half fluxes (any frits and feldspathic materials, as they will lower the melting point.) If you want to slip cast or throw, add some plasticizer, and use Darvan 7 as your deflocculant. Change the ratios or substitute materials to correct for slumping, to add vitrification, change the color, etc.
- Keep accurate records of all experiments, with photographs of each.
- Fire with an accurate pyrometer and use witness cones to ensure repeatable results.
- Coat your shelves with a good kiln wash. Your tests might stick. I suggest a wash made from 50% alumina, 25% kaolin, and 25% calcined kaolin as a starting point.

the author *Bryan Hopkins earned an MFA in Ceramics from the State University of New York at New Paltz. He has been a studio potter working in porcelain since 1990 and currently lives in Buffalo, New York. He teaches at Niagara County Community College, has curated ceramics exhibitions both nationally and locally, and has exhibited in group and solo shows nationally. His work has been published in* Ceramics Monthly, Ceramics: Art and Perception, Studio Potter, 500 Vases, *and* Best of 500 Ceramics. *Hopkins is a founding member of the online ceramics group Objective Clay. He is also a New York Foundation on the Arts Fellow in Craft.*

1 Honey, W.B., European Ceramic Art, Faber and Faber, 1952, p.533.

8 *Casserole Tower*, Corning Museum of Glass, Corning, New York. *Photo courtesy of Corning Museum of Glass.* **9–10** Aaron Nelson's chandelier (and detail), *On the Knifes Edge*, 98 in. (2.5 m) in height, press-molded, soft-paste porcelain with platinum decal, fired in an electric kiln to 1987°F (1086°C), aircraft cable, aluminum, steel, 300 RGB LED lights, microcontoller. **11** Justin Rothshank's cups, to 4 in. (10 cm), low-fire porcelain, fired to cone 04, decals, luster decals, fired to cone 017.