

# Downdraft Bucket Kiln: Bridging Fire, Form, and Community

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## Abstract

This paper explores the evolution of alternative firing methods in my ceramic practice, beginning with simple metal can firings and culminating in the development of a portable downdraft bucket kiln. Inspired by the downdraft barrel kiln popularized by Randy Brodnax, this compact design offers an accessible and efficient approach to atmospheric firing. My research spans multiple areas: experimenting with contemporary luster firing techniques, reviving traditional Islamic geometric patterns through ceramic surfaces, and integrating digital fabrication tools such as 3D-printed stencils and stamps. These investigations reflect a broader inquiry into how ancient aesthetics and modern technologies can converge in the studio, offering new possibilities for expression, pedagogy, and cultural continuity.

## 1. Introduction: From Metal Can to Downdraft Kiln

Inspired by the dynamic workshops of Randy Brodnax, my husband, Luis Orozco, and I began exploring alternative firing methods that blend accessibility with expressive potential. Our journey started with a basic metal can kiln—an entry point that revealed both the possibilities and limitations of rudimentary atmospheric firing.

Driven by curiosity and a desire for greater control, we constructed a downdraft bucket kiln modeled after Brodnax's Downdraft Stovepipe Barrel Kiln design. This version offered improved airflow and temperature consistency, enabling more nuanced surface effects, particularly when doing aluminum paper saggar firings with ferric chloride. The kiln reliably reached temperatures between 750°C and 800°C, opening new avenues for experimentation.

We later scaled up to a full-sized metal trashcan downdraft kiln, which we tested during a collaborative session with 40 geometry artists in New Mexico in September 2024.

Despite the density of over 50 paper clay tiles, the kiln maintained even heat distribution, demonstrating the design's robustness and scalability.



**Figure 1.** Early metal can kiln setup with airflow holes at the bottom.



**Figure 2.** Downdraft bucket kiln inspired by Randy Brodnax, built by Luis Orozco, Samia van Hattum, and Fabiola De la Cueva at Samia's house. Picture courtesy of Samia van Hattum.

## 2. Construction of the Downdraft Metal Trashcan Kiln

To refine our design, we chose metal flashing over stovepipe for its flexibility and ease of installation. We began by cutting a circular opening near the bottom of the trash can using a drill and metal shears. This opening accommodated the intake tube, which was positioned horizontally to allow airflow without requiring a grill between the tube and the firing chamber.



**Figure 3.** Drilling and cutting the intake hole at the base of the trash can.

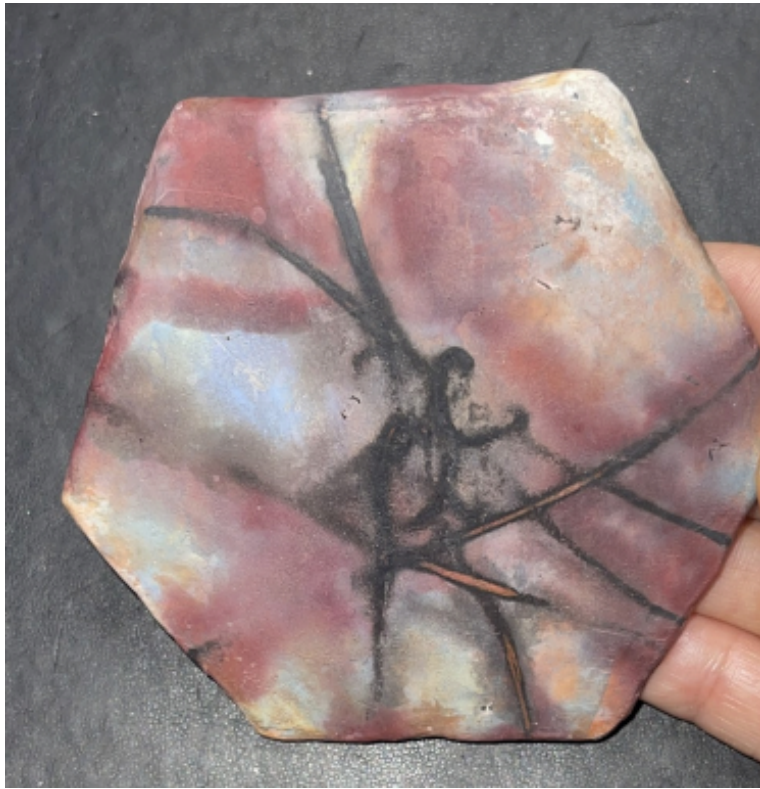
We secured the chimney to the trash can using high-temperature-resistant wire attached to bolts in the trash can for stability. Ceramic pieces were placed directly among the wood fuel, and ferric chloride solution was applied using droppers, always with eye protection, gloves and protective clothing.



**Figure 4.** Chimney attachment using high-temperature wire.

Once the fire was lit, we monitored the smoke from the chimney. To avoid excessive reduction, we left a small gap when placing the lid, allowing some smoke to escape. During the maiden firing, our excitement led us to pull pieces while the coals were still glowing red. After cooling, we scrubbed them clean with water and a kitchen sponge.

One standout piece from this firing was a tile I call "The Warrior." Made from copper wire, the figure bore a striking, laminated sword-like mark. I had also sprinkled copper carbonate and cobalt carbonate on the surface, along with a touch of blue underglaze.



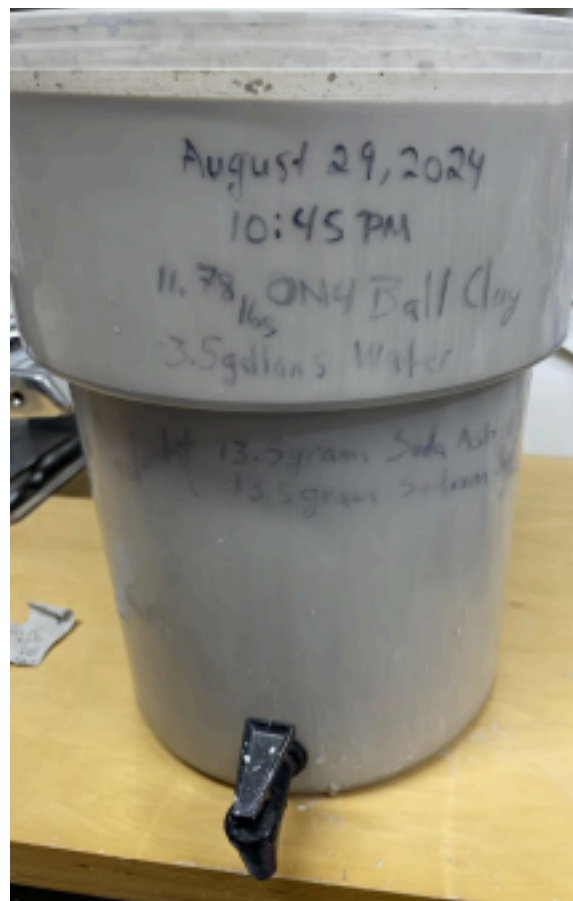
**Figure 5.** “The Warrior” tile with copper wire and carbonate effects.

### 3. Terra Sigillata: Recipes and Refinement

To refine the terra sigillata, I consulted recipes and notes from Val Cushing, Vince Pitelka, and Pete Pinnell. I normalized the quantities and developed the following recipe:

- 11.78 lbs OM4 Ball Clay
- 3.5 gallons of water
- 13.5 grams soda ash
- 13.5 grams sodium silicate

We documented the date and time of mixing and used a hydrometer to measure the specific gravity (SPG), which registered at 1.150. After 20 hours and 30 minutes, we performed the first siphoning, followed by a second one later.



**Figure 6.** Terra sigillata preparation setup with hydrometer and mixing tools.

The resulting terra sigillata was exceptionally fine. Even when applied after bisque firing, it produced a beautiful sheen with just a bit of plastic burnishing.

We also explored the effects of various mica powders. Most yielded earthy brown tones, though

a few, like Patagonia Purple by TKB Trading, retained their distinctive color even after firing.



**Figure 7.** Fired test tiles showing mica powder variations. Clockwise starting bottom left: Test tile with terra sigillata with TDK Trading Patagonia Purple mica powder and copper attachments before dipping in ferric chloride. Test tile after firing in the can kiln. Preparing test tiles before firing in the downdraft bucket kiln. Importance of clear notes on tiles. Test pieces used during the event with geometry artists.

## **4. Instrumentation: Thermocouples and Oxygen Sensors**

Until now, we've relied on an infrared temperature sensor to monitor our firings. For upcoming sessions, we plan to integrate a Type K thermocouple housed in a ceramic sheath, inserted directly into the kiln. This will allow for more accurate, real-time temperature readings and better control over the firing curve.

We've learned that placing the lid on the trash can helps retain heat, but it must be done with care; restricting oxygen too much results in overly reduced surfaces. Achieving the right balance between containment and airflow remains a delicate dance.

Our exploration of oxygen sensors has been more challenging. While some sensors can detect the presence of reduction, they fall short in quantifying its degree. High-end sensors with the capabilities we need cost upwards of US\$20,000, which is far beyond the scope of our DIY setup. We continue to research more accessible alternatives.

## **5. Reflections: Fire, Community, and the Uncontrollable**

What I cherish most about this project is the sense of community it fosters. There's something timeless about gathering around a fire, waiting for transformation to emerge. Friends who visit are captivated by the process, though once I walk them through the steps of making terra sigillata or constructing the kiln, they usually opt to join me again rather than replicate it themselves!

Still on my list is to experiment with using a ceramic saggar inside the downdraft kiln to replicate the luster effects I studied at the Escuela Nacional de Cerámica with the Iranian luster masters, the Tavasolian brothers. From my research, an updraft kiln may be better suited for this purpose, especially since luster firing often requires pulling samples mid-firing to evaluate the quality of the metallic sheen.

As an artist, I've come to accept that in ceramics, you can encourage results, but never fully control them. As an engineer, I remain committed to identifying variables, understanding their interactions, and refining the process to increase the odds of success. Somewhere between the two lies the magic: a space where knowledge, intuition, and fire converge.



**Figure 8.** The orb fired in the downdraft bucket kiln. The lower left picture shows the orb before adding the ferric chloride. Firing picture in the center courtesy of Robyn Frank.



**Figure 9.** Tiles fired with geometry artists during art retreat in New Mexico.

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