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Ceramic "Waffles"

Press Form, Heat Set (PFHS) technique

Fired ceramic 'waffles' can be used for setter plates or separator pieces when heat-treating/firing other parts. Due to the porosity of the waffles, they provide good thermal insulation. And, a fired waffle can be coated with any of our specialty coatings to provide even more stability. For example, coating with yttria, zirconia, or alumina using Y Aerosol, Z Aerosol, or A Aerosol [or their "Aerosol Brushable" versions] is an easy way to achieve this.

How to Make Your Own Ceramic Waffle

The wafflemaker used was … DASH Mini Waffle Maker – 4" Waffle Mold

A ceramic "waffle" can be made with the small wafflemaker using **Cera Mastic** – water-based ceramic putty material …

1. Pre-coat the waffle surface with cooking oil (Canola or other) to ease the waffle release. Plug in the DASH unit and wait until the green light disappears, indicating that the surface is around 355-360°F or 179-182°C.
2. Put a glob of Cera Mastic (weight about 140 grams) onto the heated surface and gently close the top of the unit to spread out the Cera Mastic and uniformly fill the waffle maker. It may be helpful to press down on the top part for a few minutes to assure that the waffle pattern is fully pressed into the Cera Mastic.
3. Allow the unit to continue heating until the steam stops and for a few minutes more. Generally, about 10-15 minutes of heating was used.
4. Unplug the unit and allow to fully cool to room temperature. About an hour was used for this.
5. Gently remove the "ceramic waffle" from the unit.
6. Place the waffle-shaped piece into a dryer for a few hours (typically 1-2 hours) to remove volatiles.
7. Place the piece into a furnace or kiln and heated to 1300 C (2372 F or pyrometric cone 10, 11, or 12) for one hour to sinter the part. This produces a part with little shrinkage and thus fairly porous for good insulating ability. The fired part also is 'tough' with good handling strength and a ceramic 'ring' when tapped with a metal.

Cera Mastic ceramic waffle after firing to 1300 C – approximately 15% linear shrinkage

Fired Cera Mastic waffle placed back into waffle maker to show the small shrinkage on firing to 1300 C

NOTES: If desired, diluted Cera Mastic (with around 20 wt% water) may improve the filling of the waffle pattern. Also, using the dry-mix refractory powder … **Cera Mastic DMX** is an option, whereby only adding water to get to a doughy consistency and following the above procedure leads to a ceramic waffle.

Other options for making ceramic waffles have been tested cursorily …

I. **Using RefClay Y**

Using around 150 grams to fill the wafflemaker [Step 2 above] and following the above procedure results in a tough ceramic waffle but has some cracks in the waffle-flat regions. The performance could possibly be improved with some dilution and procedure tweaks.

NOTES: The other refractory claylike materials [RefClay Z and RefClay ZRP] are possible alternative materials to consider.

II. **Using Zirconia CeraCast Powder**

This was mixed with "complete" waffle mix … 32 grams of the waffle mix; 40 grams of Zirconia CeraCast Powder; 10 grams of cooking oil; 42 grams of water for Step 2 above. Then the above procedure was followed – leading to a porous ceramic waffle that was not very tough but probably usable.

NOTES: another option would be to use Yttria CeraCast Powder.

III. Using standard ceramic coatings … not recommended
   a. Zircwash
   b. Zypcoat ALT

Have been used but lead to powdery end-product ceramic waffles.

The latter two above (II and III) use “complete” waffle mix … which, on firing generates considerable smoking and fumes – thus should only be done with **very good** ventilation and realizing that the smoke/fumes are not desirable to deal with.

Safety information

- Consult the safety data sheet of these materials before use.
- Good ventilation is required when producing ceramic waffles. Do not breathe vapors or steam produced during production of the waffle.
- Take precautions and avoid touching hot [generally around 355-360°F or 179-182°C] surfaces and steam produced during the procedure.
- For industrial use only.

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