

1- Zetamix General guidelines Porcelain

Zetamix filaments are on a fine powder (5-20 μm) and a thermoplastic binder system for the FDM process. Green parts need a binder removal in a two-stage debinding process before being sintered. First debinding step is dissolving the binder in a solvent bath. In the second debinding step the remaining binder is thermally removed. These general guidelines are based on the processing of test parts with a wall thickness of 2 to 4 mm.

The recommendations are considered to work as a standard guideline and must be adapted to individual wall-thickness and part-design.

Typical material properties	
<i>Product</i>	Filament for FDM process
<i>Binder basis</i>	Polyolefinebased binder system
<i>Appearance</i>	Beige

Typical processing properties	
<i>Printing temperature</i>	130°C - 160°C
<i>Plate temperature</i>	50°C
<i>Nozzle size</i>	0.4 mm to 1 mm
<i>Layer thickness</i>	0.20 mm (possibility to go from 0.1 to 1mm, need to adjust printing speed)
<i>Printing speed</i>	40 mm/s (recommended)
<i>Debinding process :</i>	Two-stage debinding process
<i>1st step : chemical debinding</i>	24 hours in an acetone bath at 40°C (it depends on the geometry of the part), stop the heat a couple of hours before removing it from the bath → Mass loss > 12% 2 hours drying in ambient atmosphere
<i>2nd step : thermal debinding</i>	From 50°C to 500°C with a 7°C/h ramp 2 hours holding time
<i>Sintering process</i>	In a high temperature furnace Up to 1250°C with a 125°C/h ramp 2 hours holding time
<i>Sintering shrinkage rate</i>	In x,y direction = 13.8% \pm 1% In z direction = 26.4% \pm 1%
<i>Oversize factor</i>	In x,y direction = 116.0% In z direction = 136.0%

Printing instructions:

The filament is softer than plastic filaments. Therefore, it is preferable to use a driving gear which is not too much aggressive and will not crush the filament (ideally a grooved driving gear). The filament can be grinded by the extruder, that's why it should be cleaned before a long print. To make sure that the printer is ready we recommend preheating the system and start extruding some material. If nothing come out of the nozzle there might be a clog. Therefore, the nozzle must be replaced or cleaned.

In order to avoid filament grinding, we recommend to load the filament without any pressure at all and then delicately increase it until the filament just gets pushed through the PTFE tube. We recommend printing the piece on flexible plate. The part can be detached by bending it.

The filament is advised to be used for one year.

Printing parameters: Refers to the IdeaMaker parameters guidelines

Scale : 116,0% (x and y) / 136,0% (z)

Printing speed: from 5 to 40 mm/s depending on the shape of the part

Layer height: from 0.1mm to 1mm

Retraction: Yes (but not necessary)

Fan speed: 100%

Wall line count: 3 recommended (at least two)

Infill: any 2D pattern (triangles, grid, honeycomb, rectilinear)

Infill density: from 100% down to 15% (the top surfaces above the infill depends on the pattern infill density)

Top/bottom surface number:

- for a 0.1mm layer height: 8
- for a 0.2mm layer height: 4

2- Debinding Recommendations

First step: solvent debinding (acetone bath)

Step 1: Solvent bath

- It is recommended to debind the printed parts in an acetone bath at 40 °C.
- At least 12% of the weight of the piece should be removed during the solvent debinding step (after drying).
- The duration is depending on wall thickness and part geometry but takes at least 2 hours.

Step 2: Drying

- Let the parts dry at the ambient air (the part can be placed on a tissue to absorb the water)
- The duration is depending on wall thickness and part geometry but takes at least 2 hours.
- This step is essential to measure the mass removed by the solvent debinding step

Second step: thermal debinding

Place the parts in a crucible on a refractory powder bed to accommodate shrinkage and support the part during debinding.

The most reliable process consists of a heating rate of 7°C per hour from 50°C to 500°C. It takes 2 and a half days to complete the debinding.

3- Sintering Recommendations

Sintering in a high temperature furnace

Thermal cycle: 50°C -> 1250°C with 125°C/h ramp, in 10h

holding time 2h

1250 -> 50°C with 125°C/h ramp, in 10h

Because of the shrinkage, there is a change of volume. Please modify the scale in the slicer before printing, as it is said in "Printing parameters".

If you want to enamele, you must stop the sintering at 1000°C to pre-sinter your parts. You can then apply the enamelling by dipping it for more even layers, or with a brush.

Once the enamelling done, you have to restart the sintering process up to 1250°C this time.