1- Zetamix General guidelines White Zirconia

Zetamix filaments are on a fine powder (< 1.0 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 mm.
The recommendations are considered to work as a standard guideline and must be adapted to individual wall-thickness and part-design.

Filament characteristics

Typical material properties	
Product	Filament for FDM process
Binder basis	Polyolefinebased binder system
Appearance	White filament

Typical processing properties	
Printing temperature	180 °C
Plate temperature	40 °C
Nozzle size	From 0.4 mm to 1 mm (need to ajust the printing speed, the wider the nozzle the slower) 0.6mm recommended
Layer thickness	0.2mm (possibility to go from 0.1 to 1mm, need to ajust printing speed)
Printing speed	10mm/s - 25mm/s
Debinding process :	Two-stage debinding process
1st step : chemical debinbing	6 hours in an acetone bath at 40°C (it depends on the geometry of the part) → Mass loss > 5% 2 hours drying in ambient atmosphere
2nd step : thermal debinding	Thermal debinding up to 500 °C with a 8°C/h ramp
Sintering	20°C to 1475°C with a 50°C/hour ramp 2 hour holding time
Shrinkage rate	21.5%±1% (x, y and z)

Printing instructions:

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 comes out of the nozzle there might be a clog. Therefore, the nozzle must be replaced or cleaned.

We recommend the use of a wear resistant nozzle, for instance with a ruby or ceramic tip.
We recommend printing the piece on a glass plate in order to obtain a good surface quality. The part can be detached from the build plate using an ultrasound bath.

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Printing parameters: Refers to the IdeaMaker parameters guidelines

Scale (oversize factor): 127.4%
Printing speed: from 10 to 25 mm/s depending on the shape of the part
Layer height: from 0.3mm down to 0.1mm
Retraction: 1mm at 20 mm/s
Fan speed: 100% (the higher the better the print quality)
Wall line count: at least two
Infill: any 2D pattern (triangles, grid, honeycomb, rectilinear)
Infill density: from 100% down to 5% (the top surfaces above the infill depends on the pattern infill density)
Top/bottom surface number:

- for a 0.1mm layer height: 10
- for a 0.2mm layer height: 5

Supports structure: Can be printed using the same material or a soluble material via a dual extrusion system. In order to have a great surface quality at least 3 dense top layers should be printed between the support structure and the part.

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 5% 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 8°C per hour from 20°C to 500°C. It takes 2 and a haf days to complete the debinding.

For small parts the process can be as described below:

segment	From (°C)	To (°C)	Heating rate (°C/h)	Dwell time (h)	Segment duration (min)	Duration in total (h)
0		20			0	0
1	20	125	35		180	3h
2	125	200	50		90	4h30
3	200	215	22		40	5h10
4	215	250	11		180	8h10
5	250	280	20		90	9h40
6	280	320	8		300	14h40
7	320	510	24		480	22h40

3- Sintering Recommendations

Sintering in a high temperature furnace

Thermal cycle: 20 - > 1475°C with 50°C/h ramp, in 29h
holding time 2h
1475 - > 20°C with 100°C/h ramp, in 15h

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”.

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