Catamold® TZP-F 315

Product
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Product Description
Ready-to-mold granules for the production of sintered ceramic components in *polycrystalline yttria-stabilised tetragonal zirconia* using the BASF system.

Manufacturer
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Tool design
The tool must be designed with flow paths as short and as thick as possible. The shrinkage which arises during processing must be considered by oversizing the mold dimensions. Every dimension must be multiplied by this oversizing factor which is defined in the pertinent specification.

Injection Molding
Processing on standard injection molding machines for thermoplastic polymers with cylinder and screw in hard materials for wear protection. The starting values for optimization, based on an Arburg 370C 800-225 are:

<table>
<thead>
<tr>
<th>Barrel temperature</th>
<th>Zone 1 170 °C</th>
<th>Zone 2 172 °C</th>
<th>Zone 3 172 °C</th>
<th>Nozzle 175 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mold temperature</td>
<td>138 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screw speed</td>
<td>50 min⁻¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injection speed</td>
<td>20 cm³/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cushion</td>
<td>4 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molding pressure</td>
<td>800 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding pressure</td>
<td>800 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding time</td>
<td>8 s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pressure</td>
<td>20 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Temperatures higher than 180 °C, screw speeds higher than 50 min⁻¹ and mold temperatures higher than 145 °C must be avoided. Screws which develop only low shear are preferred; compression ratios of 1.6:1 are recommended.

Debinding
Debinding according to the BASF process at 110 °C using HNO₃ > 98 %. The formaldehyde evolving from the parts during debinding can react with any oxidizing agent. Explosion limit of formaldehyde with oxygen is 4.5 % by volume. There is some indication that a slow reaction between formaldehyde and nitric acid exists. Therefore any unintended high dose of nitric acid must be avoided.

In order to avoid entry of air through a leakage we refer to the manual of the oven suppliers. We highly recommend to keep the maintenance intervals for the door seals and the bearings of the circulation fan.
Based on a 50 litre debinding furnace (e.g. Heraeus VT 6060 MU 2) a nitric acid feed of typically 30 ml/h and a purge gas (nitrogen) throughput of 500 l/h proved to lead to safe processing. At this gas throughput the acid feed may not be increased to more than 38 ml/h. The debinding process is finished when a minimum debinding loss of 17.5% is reached.

**Sintering**

Sintering should be performed in air. A mild purge of air up to 600 °C, where desorption of nitric acid and residual binder burnout is complete is recommended. As sintering support Al\(_2\)O\(_3\) with a purity of 99.6% is recommended, e.g. Frialit\textsuperscript{®} AL 23 (Friatec AG).

A typical sintering cycle is:
room temperature – 3 K/min – 270 °C, hold 1h,
270 °C – 3 K/min – 1500 °C, hold 1h
1500 °C – 5 K/min – 600 °C
furnace cooling

**HIP treatment**

Sintered parts may optionally be subjected to a HIP treatment to close residual porosity and gain additional strength.
A typical HIP cycle using Argon gas is:
room temperature – 5 K/min – 1350 °C, hold 2 h,
1350 °C – 3 K/min – 1200 °C,
furnace cooling

**Note**

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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