

## High-pressure pistons

made of technical ceramics



### High-pressure pistons made of technical ceramics

Application: Economic conveyance of liquid, abrasive and highly viscous substances, **exposure up to 6.000 bar possible!**

Pistons made from our oxide ceramic materials Al998, Al999-HIP, ZTA, ATZ-HIP, TZP-A and PSZ are used for pumping highly viscous to liquid media. Long service life, even under extreme pressures, are achieved by the optimal wear resistance and good sliding properties.

When exposed to aggressive chemical attack in combination with high dynamic loads, we recommend our HIPed materials (HIP = hot isostatic postcompacted). Especially the extremely increased fatigue resistance prolongs the service life even in difficult applications.

**For each application we offer suitable materials in the required dimensions.**

#### Materials:

##### Alumina:

Al998, Al999-HIP and ZTA

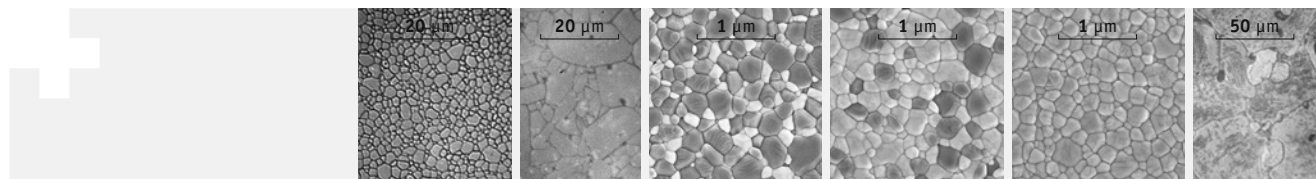
##### Zirconia:

TZP-A, ATZ-HIP, PSZ

#### Fields of applications:

- High-pressure cleaning of buildings, tanks, ships, etc.
- Flushing and cooling
- Waterjet cutting systems
- Oil and gas conveyance
- Fresh water generation (reverse osmosis)

## Oxide ceramics



| Designation                          |                     | Al999-HIP  | Al998                                       | ZTA   | ATZ-HIP   | TZP-A   | PSZ                            |
|--------------------------------------|---------------------|--|---|---|---|---|--------------------------------|
| Components                           |                     | Al <sub>2</sub> O <sub>3</sub>                                     | Al <sub>2</sub> O <sub>3</sub>              | Al <sub>2</sub> O <sub>3</sub> /ZrO <sub>2</sub> /Y <sub>2</sub> O <sub>3</sub> | ZrO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> /Y <sub>2</sub> O <sub>3</sub> | ZrO <sub>2</sub> /Y <sub>2</sub> O <sub>3</sub> /Al <sub>2</sub> O <sub>3</sub> | ZrO <sub>2</sub> /MgO          |
| Purity                               | %                   | 99.9   | 99.8  | 75/23/2   | 76/20/4   | 95/5/0.25   | 96.5/3.5                       |
| Density                              | g/cm <sup>3</sup>   | 3.98   | 3.86  | 4.40  | 5.50  | 6.05  | 5.70                           |
| Open porosity                        | %                   | 0  | 0   | 0   | 0   | 0   | 0                              |
| Grain size                           | µm                  | 1.8  | 5   | 0.7   | 0.4   | 0.35  | 20                             |
| Hardness Vickers                     | Hv                  | 2100   | 1900  | 1700  | 1400  | 1200  | 1500                           |
| Hardness Mohs                        |                     | 9  | 9   | 8.5   | 8   | 8   | >8                             |
| Compressive strength                 | MPa                 | 3800   | 2500  | 2300  | 2000  | 2000  | 2000                           |
| Flexural strength                    | MPa                 | 500  | 350   | 900   | 2000  | 1200  | 500                            |
| Young's modulus                      | GPa                 | 380  | 350   | 270   | 220   | 210   | 200                            |
| Fracture toughness K <sub>IC</sub>   | MN/m <sup>3/2</sup> | 4  | 3.5   | 5.3   | 8   | 8   | 10                             |
| Poisson ratio                        | -                   | 0.24   | 0.24  | 0.26  | 0.30  | 0.31  | 0.23                           |
| Max. operating temperature           | °C                  | 1900   | 1900  | 1000  | 1000  | 1000  | 1000                           |
| Thermal expansion (20-1000°C)        | 10 <sup>-6</sup> /K | 8.0  | 8.0   | 8.5   | 9   | 10  | 10                             |
| Thermal conductivity                 | W/mK                | 30   | 29  | 22  | 6   | 2.5   | 2                              |
| Specific heat                        | J/kg K              | 900  | 900   | 800   | 600   | 500   | 550                            |
| Dielectric strength                  | kV/mm               | 35   | 30  | -   | -   | -   | -                              |
| Electrical resistivity (20°C/1000°C) | Ω cm                | >10 <sup>14</sup> /10 <sup>9</sup>                                 | >10 <sup>14</sup> /10 <sup>9</sup>          | -   | -   | -   | -                              |
| Dielectric constant (100 MHz)        | ε                   | 9.6  | 9.6   | -   | -   | -   | -                              |
| dielektr. Verlustfaktor              | tan                 | 10 <sup>-4</sup>   | 10 <sup>-4</sup>                            | -   | -   | -   | -                              |
| <b>Shaping procedures:</b>           |                     |  |   |   |   |   |                                |
| Isostatic pressing                   |                     | ✓  | ✓   | ✓   | ✓   | ✓   | ✓                              |
| Die pressing                         |                     | ✓  | ✓   | ✓   | ✓   | ✓   | ✓                              |
| HIP                                  |                     | ✓  |   | ✓   | ✓   | ✓   |                                |
| <b>Suggested applications</b>        |                     |  |   |   |   |   |                                |
|                                      |                     | Bioceramics, precision parts, spheres<br>DIN ISO 6872:2009 Class 5 | Pistons, plates precision parts, insulators | Bioceramics, precision parts, spheres, pistons<br>DIN ISO 6872:2009 Class 5     | Bioceramics, heavy-dutywear-resistant parts<br>DIN ISO 6872:2009 Class 5        | Bioceramics, precision parts<br>DIN ISO 6872:2009 Class 5<br>DIN ISO 13356      | Tubes, plates, precision parts |

All information and data correspond to the present state of our knowledge concerning properties and applications. They do not guarantee certain properties for products designed for specific applications utilizing material(s) described herein. We guarantee, however, first rate quality described in our terms of delivery.

### Metoxit AG

Emdwiesenstrasse 6  
CH-8240 Thayngen, Switzerland  
phone +41 52 645 01 01  
fax +41 52 645 01 00  
www.metoxit.com  
info@metoxit.com