



MAGNESIA STABILIZED ZIRCONIA (MSZ)

Transformation toughened zirconias such as Magnesia-Stabilized Zirconia have small precipitates of tetragonal phase which are formed inside of the cubic phase grains. These precipitates transform from the meta-stable tetragonal phase to the stable monoclinic phase when a crack attempts to propagate through the material. The result promotes toughness. Compared to YTZP, MSZ is more stable in high temperature (220C and above), high moisture environments.



PRIME FEATURES

- High mechanical strength
- High temperature resistance
- Very high wear resistance
- Very high impact resistance
- Very low thermal conductivity
- Thermal expansion suitable for ceramic-to-metal assemblies
- High chemical resistance (acids/bases)

TYPICAL APPLICATIONS

- Deep well, down hole components
- Wear parts
- Structural ceramics
- Precision valve seats and seals
- Roller guides for tube forming
- MWD tools
- Bushings
- Wear sleeves
- Pump pistons
- Pump sleeves
- Spray nozzles
- Ceramic bearings
- Solid oxide fuel cell components



MAGNESIA STABILIZED ZIRCONIA SPECIFICATIONS

| | Property | ASTM Method | Units | MSZ (Magnesia Stabilized) |
|-----------------|----------------------------------------|----------------|------------------------------|------------------------------|
| General | Crystal Size (Average) | Thin Section | Microns | 30 |
| | Color | -- | -- | Ivory or Yellow |
| | Gas Permeability | -- | atms-cc/sec | gas tight <10 ⁻¹⁰ |
| | Water Absorption | C 20-97 | % | 0 |
| Mechanical | Density | C 20-97 | g/cc | 5.72 |
| | Hardness | Vickers 500 gm | GPa (kg/mm ²) | 11.7 (1200) |
| | Hardness | -- | R45N | 78 |
| | Fracture Toughness | Notched Beam | MPam ^{1/2} | 12 |
| | Flexural Strength (MOR) (3 point) @ RT | F417-87 | MPa (psi x 10 ³) | 620 (90) |
| | Tensile Strength @ RT | -- | MPa (psi x 10 ³) | 310 (45) |
| | Compressive Strength @ RT | -- | MPa (psi x 10 ³) | 1862 (270) |
| | Elastic Modulus | C848 | GPa (psi x 10 ⁶) | 206 (29.8) |
| Poisson's Ratio | C848 | -- | 0.28 | |
| Thermal | C.T.E. 25 - 100° C | C 372-96 | x 10 ⁻⁶ /C | 8.9 |
| | C.T.E. 25 - 300° C | C 372-96 | x 10 ⁻⁶ /C | 9.7 |
| | C.T.E. 25 - 600° C | C 372-96 | x 10 ⁻⁶ /C | 10.0 |
| | Thermal Conductivity @ RT | C 408 | W/m K | 3 |
| | Max Use Temp | -- | Fahrenheit (°F) | 2200 |
| | -- | Celsius (°C) | 1200 | |
| Electrical | Dielectric Strength (.125" Thick) | D 149-97A | V/mil | 300 |
| | Dielectric Constant @ 1 MHz | D 150-98 | -- | 22.7 |
| | Dielectric Constant @ Gigahertz | D 2520-95 | -- | 29.2 |
| | Dielectric Loss @ 1 MHz | D 150-98 | -- | 0.0016 |
| | Dielectric Loss @ Gigahertz | D 2520-95 | -- | 0.0018 |
| | Volume Resistivity, 25°C | D 257 | ohms-cm | > 1 x 10 ¹³ |
| | Volume Resistivity, 300° C | D 1829 | ohms-cm | 5 x 10 ⁷ |
| | Volume Resistivity, 500° C | D 1829 | ohms-cm | 1 x 10 ⁷ |
| | Volume Resistivity, 700° C | D 1829 | ohms-cm | 2 x 10 ⁶ |

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