

Precision Ceramics Introduces its Toughest Composite Yet

Dubbed “ceramic steel”, zirconia (ZrO_2) ceramic materials offer a combination of high hardness, wear and corrosion resistance while still maintaining one of the highest figures for fracture toughness available.



Fig. 1
Tubes made of CeramaZirc Ultra Tough

Following a period of intense in-house development, Precision Ceramics/GB has introduced a new ultra-high fracture toughness zirconia composite to its already wide and comprehensive portfolio of materials. Nicknamed “The Orange One”, CeramaZirc Ultra Tough is an advanced zirconia-based ceramic composite material based on partially stabilised zirconia and alumina platelets and is the latest and toughest composite to be introduced.

Precision Ceramics already offers a wide range of zirconia materials from conventional sintered zirconia to high performance CeramaZirc Nano HIP, consolidated by hot isostatic pressing. Also available are CeramAlloy ATZ and ZTA, a range of zirconia-alumina ceramic composite materials

Keywords
zirconia, fracture toughness, high pressure applications

in different proportions between their main constituents to cover a wide range of mechanical properties and intended uses.

Key properties of CeramaZirc Ultra Tough include use temperatures up to 1500 °C and no compromise between bending strength, hardness and fracture toughness. Other key properties include:

- remarkably high fracture toughness and impact resistance while maintaining above average values for bending strength and hardness;
- toughening by crack deflection provided by unique microstructure of alumina platelets in a partially stabilised zirconia matrix;
- Hot Isostatically Pressed (HIP'ed) for superior strength and reliability;
- increased resistance to hydrothermal ageing through ceria partial stabilisation.

Typical uses of CeramaZirc Ultra Tough are:

- high pressure equipment – ball valve balls and seats – particularly suitable for

applications where mechanical shock, impacts and/or vibrations are present;

- ultra-high pressure pumping elements;
- flow control devices for ultra-high pressure equipment – stems and seats for high pressure homogenisers;
- deep well down-hole valves and seats;
- rollers and guides for metal forming.

Tab. 1
Physical properties of CeramaZirc Ultra Tough

CeramaZirc Ultra Tough	
Density [g/cm ³]	5,7
Flexural strength [MPa]	1000
Compressive strength [MPa] = in excess of 2000 Young's modulus [GPa]	235
Poisson ratio	0,29
Hardness HV 0,5 [GPa]	13
Fracture toughness K_{Ic} [MPa/m ²]	17
Max. use temperature [°C]	1000

* K_{Ic} toughness as measured by the indentation method

N.B.: Values presented are mean values for the samples tested and are given as an indication only for the purpose of comparing between different materials. The properties of the actual material might vary slightly and could be affected by the shape and size of the part.

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