

# Pump and Valve



Technox® ceramics are now used with increasing frequency in pump and valve applications – and the excellent erosive wear resistance of Technox® zirconia ensures both longer life and considerable cost savings. This data sheet explains the mechanics of erosive wear behaviour and provides independent, third-party data about the comparative performance of Technox® against other materials.

## Erosive Wear Process

The process of erosive wear occurs by the impact of particles on a surface, with a resultant loss of material due to fracture, spalling and/or abrasive wear of the impacted surface. Erosive wear can occur in both metals and ceramics, though due to their high hardness, ceramics are generally more resistant to erosive wear - yet there are significant differences between the two classes of material:

- **Metals:** (which display ductile deformation behaviour) the impact of abrasive particles at 90° to the surface is less damaging than more acute impact angles.
- **Ceramics:** the deformation mode tends towards brittle fracture, with 90° impacts causing the most damage.

## Experimental Evidence

Recent experimental evidence for ceramic materials has shown that, although hardness is an important parameter in controlling erosive wear, the ratio of hardness/toughness is of greater importance, so:

- 1 A hard but brittle ceramic will resist indentation by a hard indenter, but the surrounding brittle surface may crack, leading to the removal of a significant amount of material, and hence significant wear.
- 2 A softer but tougher ceramic may display higher indentation damage but the toughness of the material will avoid any surface cracking and hence the removal of large amounts of surface material, thus reducing wear.

These theories have been tested by experiment whose aim was to monitor the performance of several candidate materials for pumping applications.

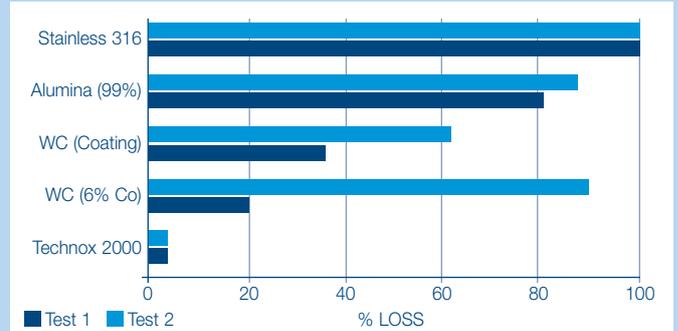
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	Test 1	Test 2
Jet Velocity	25	25
Sand Content (ppm)	1000	1000
Test Duration (mins)	30	30
Impact Angle (deg.)	45	90
pH	7	5.5



The performance characteristics detailed in this graph have been determined by a major European Pump Producer.



## Pump and Valve continued...



### Erosive Wear Test Data

Rods of the candidate materials and coatings (10 mm diameter, 30 mm long) were placed in the outlet stream of a high-pressure water jet under the conditions indicated. The volume loss of each material was measured as a relative percentage of the volume loss from a stainless steel 316 control pin, i.e. the lower the value, the more wear-resistant the material. These results indicate that Technox® 2000 displays excellent wear performance under conditions of both erosive (test 1) and erosive/corrosive (test 2) wear. The wear performance of the zirconia is some 5-18 times better than that of the Tungsten Carbide 6% Cobalt materials.

### Cavitation

In addition to their excellent erosive wear resistance, Technox® ceramics also display excellent cavitation resistance. Their uniform and homogeneous microstructure, coupled with high densities and corrosion resistance, promote low material loss during turbulent flow conditions. The quality of surface finish affects cavitation resistance, and high degrees of polish lengthen the period before cavitation erosion begins.

### Typical Applications

Technox® ceramics have a well established pedigree in many oil-field and down-hole installations throughout the world.

Typical applications include:

- plug stems and valve seats
- choke trims and choke beans
- moveable orifice valves
- gate valve seats
- ball valves and seats
- mud pump nozzles
- turbo-drill components.

One outstanding achievement was to produce a solid swash-plate pump body (approx. Ø100mm) and pistons for use by British Gas in sea-bed control systems. Running at 100 bar and with only a 1mm particulate filter, the pump performed for over 2,000 hours out-performing the steel equivalent by more than 1960 hours.

### Customer Support

Dynamic-Ceramic manufactures custom-made parts to our customers' specifications. For more details of our products and services or to discuss your specific requirements, please contact one of our Sales Engineers.

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