



Ultra-Hard Tungsten Carbide Based Coatings



## Hardide-T

**Tough, ductile and impact resistant coating for use in extremely abrasive and erosive environments**

### ▶ Hardide Coatings

Hardide® is a family of low temperature CVD (chemical vapour deposition) tungsten carbide based coatings that increase the life of critical metal components operating in abrasive, erosive and chemically aggressive environments. The coatings have a unique combination of abrasion, erosion and chemical resistant properties while being tough, ductile and impact resistant.

### ▶ Hardide-T

Hardide-T has enhanced toughness and is suitable for heavy duty applications in extremely abrasive and erosive environments where a thicker coating (typically 50 microns) is required or in applications involving shock loads where impact resistance is required.

- ▶ Coats internal surfaces and complex shapes uniformly due to non line-of-sight process
- ▶ No grinding or other expensive finishing operations required due to smooth and uniform surface 'as coated'
- ▶ Easily applied to a wide range of metals including various grades of stainless steel, tool and alloy steels, nickel, cobalt and copper-based alloys and titanium
- ▶ Applications include downhole tools, valves, flow control, pumps, sealing and bearing surfaces, heavy duty earth-moving equipment, hydraulics, powder compaction and tool & die
- ▶ Industries served include oil and gas, aerospace, valves, pumps, industrial gas turbines, pharmaceutical, pulp and paper, food processing and Formula 1.

*The specification is intended to illustrate typical properties. Engineering data is representative. Property values vary somewhat with method of manufacture, size, and shape of part. Any suggested applications are not made as a representation or warranty that the material will ultimately be suitable for such applications. The customer is ultimately responsible for all design and material suitability decisions. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which Hardide assumes legal responsibility. Any warranty or representation for which Hardide is responsible shall be subject to a separately negotiated agreement.*

*"Improve part life,  
optimise performance and  
reduce costs with  
Hardide-T coating"*

#### ▶ Further information

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### ► Key Properties of Hardide-T

PARAMETER	HARDIDE-T
Microhardness [kgf/mm <sup>2</sup> ]	1100 – 1600 Hv <sub>50</sub>
Coating Thickness	Typically 50 microns (0.002") Thicker coatings can be produced, ask for details
Coating Toughness	Excellent. Good resistance to Thermal Shock
Strain to Fracture	Higher than 0.3% (3000 microstrain)
Adhesion Tensile Bond Strength	Better than 70 MPa or 10,000 psi The actual bond strength of Hardide coating is not known. The limit given above is the ultimate strength of the epoxy adhesive used in the ASTM C633 bond strength testing
Coating Composition	Tungsten with nano-structured Tungsten Carbide Does not contain Cobalt or other metal binder materials used in Cemented Carbides and thermal spray coatings
Coating Porosity	0.04% max.
Appearance	Coating as applied is light grey Finishes to a high metallic lustre when polished
Finishing Operations	Grinding, Honing, Lapping, Polishing, Super-finishing
Surface finish	As coated 0.4 - 0.6 microns Ra Can be polished to 0.2 - 0.3 microns Ra Can be super finished to 0.02 microns Ra
Corrosion Resistance	Resistant to acids, H <sub>2</sub> S and some aggressive chemicals Passed NACE 30 day Sulphide Stress Cracking (SSC) test to NACE TM0177-2005/ASTM G39-Method B (1 bar H <sub>2</sub> S) Passed 480 hours neutral salt spray corrosion test ASTM B117
Operating Temperature Range	Up to 400°C in air and oxidizing media Considerably higher temperatures can be tolerated in inert gas atmosphere (such as Argon) or in vacuum
Coating Temperature	Typically up to 520°C max Optional 480°C max for temperature sensitive substrates
Electrical Resistivity @ 20°C	5.5 microhm-cm
Linear Coefficient of Expansion	4.3 x 10 <sup>-6</sup> per °C
Density @ 20°C	19.3 (gm/cc)
Thermal Conductivity @ 20°C	174 W/m·K
Specific Heat Capacity @ 20°C	0.132 J/g•K