



Ultra-Hard Tungsten Carbide Based Coatings



## Hardide-A

**A replacement for Hard Chrome plating developed for the aerospace industry**

### ▶ 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-A

Hardide-A has been developed specifically to meet the needs of the aerospace industry and as a direct replacement for hard chrome which faces legislative restrictions: REACH in the EU and OSHA in the US. Hardide-A matches hard chrome in thickness and hardness and outperforms the material in several key properties including enhanced protection against corrosion, wear and chemically aggressive media. The transition from hard chrome to Hardide-A is facilitated for customers as no significant changes are necessary in part dimensions or drawings.

- ▶ 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 actuators, pistons, bushes, bearings, turbine blades, valves, landing gear, pins, hooks and latches
- ▶ AS 9100 and ISO 14001 certifications

*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.*

*"Hardide has been coating aerospace components since 2005 when it engineered a solution on the Eurofighter Typhoon"*

### ▶ Further information

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### ► Key Properties of Hardide-A

| PARAMETER                            | HARDIDE-A  |
|--------------------------------------|--|
| Microhardness [kgf/mm <sup>2</sup> ] | 800 – 1200 Hv <sub>50</sub>  |
| Coating Thickness                    | Typically 100 microns (0.004")<br>Thicker or thinner 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<br>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<br>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<br>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<br>Can be polished to 0.2 - 0.3 microns Ra<br>Can be super finished to 0.02 microns Ra  |
| Corrosion Resistance                 | Resistant to acids, H <sub>2</sub> S and some aggressive chemicals<br>Passed successfully 750 hours neutral salt spray corrosion test ASTM B117  |
| Operating Temperature Range          | Up to 400°C in air and oxidizing media<br>Considerably higher temperatures can be tolerated in inert gas atmosphere (such as Argon) or in vacuum   |
| Coating Temperature                  | Typically below 500°C max<br>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  |