ADVANCED SURFACE COATING TECHNOLOGY

Hardide Coatings is the leading global innovator and provider of advanced tungsten carbide/tungsten metal matrix composite coatings that significantly extend the working life of critical metal components operating in abrasive, erosive, corrosive and chemically aggressive environments.

Hardide® is a family of nanostructured and patented, low temperature CVD (chemical vapour deposition) coatings which provide exceptional wear, corrosion, galling and fatigue resistance and uniquely combine enhanced toughness and ductility with high hardness. Our coatings are “value-adding” to components and lower operational costs by reducing downtime, increasing productivity and improving performance. They can be precision applied to external and internal surfaces including complex geometries, enabling a level of engineering design flexibility not possible with alternative technologies.

Hardide surface engineering technology transforms the way that parts perform under severe service conditions. Previously, levels of friction, abrasion and aggressive chemical attack have led to part failure, downtime and extreme cost. Our coatings are enabling customers in high wear/high value industries including oil and gas drilling and production, aerospace, flow control, power generation and precision engineering to optimise part life, improve product performance and make significant operating cost savings.
THE FACE OF PERFORMANCE

Expertise and Capabilities

The Hardide range of patented tungsten carbide/tungsten metal matrix composite coatings are manufactured at our facilities in the UK and USA.

We are continually evolving and enhancing our range of Hardide CVD coatings and working on new variants to solve even more engineering design and durability problems. The experience of our in-house technical and engineering teams, and the flexibility of the Hardide coatings’ properties means that we can engineer a solution for many complex applications and wear, erosion or corrosion problems that other coating technologies cannot solve.

Our state-of-the art laboratory equipment including CMM, scanning electron microscope and XRF for equipment analysis ensures premium product quality.

We offer industry leading delivery times with a quick turnaround of coated parts.

Hard Chrome, HVOF and Cadmium Replacement

Designed to be harder than quartz sand, Hardide-T is our most widely used coating. It has enhanced toughness and is used in heavy duty applications in extremely abrasive and erosive environments where a thicker coating is required or in applications involving shock loads where impact resistance is required.

Hardide-A is an environmentally compliant and technically superior replacement for hard chrome plating (HCP) and HVOF coatings. It outperforms each in several critical areas and provides enhanced protection against corrosion, chemically aggressive media, wear, galling, fretting and fatigue. Hardide-A has full flying component approval from Airbus as an alternative to HCP on a range of specific Airbus aircraft components.

Hardide-W has been developed for advanced engineering applications that do not require high hardness and wear resistance but will benefit from all the other Hardide coating properties. It is an environmentally compliant alternative to cadmium plating.

Quality Focus

Our sustained commitment to quality, service and support has been acknowledged through the achievement of leading industry standards and approvals from our customers in the oil and gas, flow control, aerospace and precision engineering sectors. Our UK and USA manufacturing sites are approved to ISO 9001 and AS 9100 certification. The UK site is also accredited to ISO 14001 and Nadcap.
PROPERTIES OF HARDIDE COATINGS

Can be applied to external and internal surfaces and complex geometries

The gas phase deposition process means that the coating is deposited uniformly and conformally on external and internal surfaces, including complex geometries, enabling new design possibilities.

Wear and abrasion resistant

Proven under ASTM G65 abrasion testing, Hardide-T is:
- 6 X more wear resistant than HVOF WC-83% / Co-17%
- 24 X better than hard chrome plating (HCP)
- 30 X better than D2 tool steel
- 46 X better than Stellite 6
- 500 X better than Inconel 718

Nanostructured

Provides a combination of high hardness with excellent toughness and ductility.

Erosion resistant

The combination of high hardness with enhanced toughness provides excellent protection against erosion at various impingement angles.
- 7 X lower erosion rate compared to the average value of HVOF WC-10Co-4Cr
- 125 X lower erosion rate than stainless steel

Corrosion resistant

The homogeneous nanostructure provides superior corrosion protection compared with other coatings and has a volume porosity of <0.5% (effectively pore-free) as measured in accordance with ASTM E2109. Hardide coating protects the substrate against aggressive chemicals including HCl, H₂SO₄, H₂S and some molten metals. Independently tested to ASTM B117-07a standard and compared with HCP and HVOF, the Hardide coated samples showed only light staining whereas the HCP and HVOF samples were badly corroded and failing.

Hardness & thickness

Microhardness can be controlled between 400 Hv and 3500 Hv and thickness between 5 and 120 microns/ up to 0.005" (higher hardness sets some limitations on the maximum thickness). The most popular coating targets a minimum of 1100 Hv (70 HRc) - developed specifically to be harder than quartz sand - and a typical application thickness of 50 microns (0.002"). Due to its impressive wear resistance, a 50 micron thick Hardide coating can achieve comparable or superior performance to much thicker layers of other hard coatings.

Impact resistant

Deposited as a uniform, crack-free coating that is both tough and ductile and will survive substrate deformations and shock loads.

Tough and ductile

The coating has been successfully tested to withstand substrate elongation of 0.3% of its length (equivalent to 3000 microstrain) without any micro-cracks or damage.

In customer tests, the coating is shown to crack only in areas where the substrate exceeds its yield limit.

Anti-galling

Excellent galling resistance under high load and high velocity dry sliding contact conditions. In reciprocating dry sliding TE77 test, the Hardide/Hardide combination did not gall even under the test rig’s maximum contact pressure of 810 MPa.

Binder-free

Deposited in a gas crystallisation process chemically bonding a tungsten carbide/tungsten alloy to the surface of metal components. The uniform structure is free from any binder material such as cobalt. As a result, the coating finish does not degrade as it wears.

Low friction

The coating polishes as it wears due to its homogeneous microstructure. Runs extremely well when in contact with itself or with softer materials such as elastomeric seals, packing or metals ranging from brass to Inconel.

Smooth and uniform ‘as coated’ finish

Applied in a batch process, the coating can be polished easily to Ra 0.2 - 0.3 microns (8-12 microinches) or super-finished to Ra 0.02 (0.8 microinches) without the need for grinding. This finish lasts longer and can withstand harsher conditions compared to WC/Co. The coating is seal friendly and non-abrasive to elastomeric, PTFE, or PEEK type seals ensuring a longer leak-free performance preventing wear of counterparts made of softer metals or elastomers.

Environmentally compliant replacement for HCP, HVOF and cadmium

Hardide-A matches the standard thickness (50-100 microns) and hardness (800-1200 Hv) of HCP. The switch from HCP to Hardide-A is easy as dimensional changes or re-design are not usually necessary.
THE COATINGS RANGE

A number of standard coatings are offered based on the individual application and operating environment. The coatings can be tailored to specific requirements.

Ultra-low temperature variants, Hardide-LT and Hardide-LA, have been specially developed for coating grades of steel and alloys whose mechanical properties may be sensitive to the normal process temperature of 500°C / 932°F. Hardide-LT and Hardide-LA are produced at the significantly lower temperature of 350°C / 662°F.

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<tbody>
<tr>
<td>Hardness Range</td>
<td>1100-1600 Hv (70-77 Rc*)</td>
<td>800-1200 Hv (64-72 Rc*)</td>
<td>400-500 Hv (40-49 Rc*)</td>
<td>400 Hv (40 Rc*)</td>
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<tr>
<td>Toughness</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
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<tr>
<td>Thickness</td>
<td>Typically 50 μm/ 0.002&quot;</td>
<td>Typically 50-100 μm 0.002 - 0.004&quot;</td>
<td>Typically 5-100 μm/ 0.0002 - 0.004&quot; Thicker or thinner coatings can be produced, ask for details</td>
<td>Typically up to 50 μm/ 0.002&quot;</td>
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<tr>
<td>Typical Applications</td>
<td>High wear/high value parts including drilling tools, flow control and subsea components</td>
<td>Hard chrome and HVOF replacement</td>
<td>Cadmium replacement. Acid-resistant parts for electronics manufacturing and analytical equipment</td>
<td>Metallurgically bonded protective coating for TSP diamonds used in most demanding applications</td>
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*the Rockwell (Rc) values are for illustration only as the Rc hardness test method uses high loads which are not suitable for coatings
INDUSTRIES

Hardide coatings extend the life of critical components for a wide range of industries and applications including:

**Oil & Gas**
- Artificial lift equipment
- Ball valves
- Cementing tools
- Choke valves
- Completion equipment
- Drill stem test tools
- Expandable tools
- MWD and LWD tools
- Mud pumps
- ROV parts
- Rotary steerable tools
- Sand screens
- Subsea chokes
- Subsea stab connectors
- Turbo drilling tools
- Well stimulation tools

**Flow Control**
- Ball valves
- Control valves
- Choke valves
- Cylinders
- Diverter
- Housing
- Impellers
- Plug valves
- Plungers
- Positive displacement pumps
- Rotors
- Shafts
- Sleeve bearings
- Triple offset butterfly valves
- Valve stems
- Vanes

**Aerospace**
- Bearing systems
- Door mechanisms
- Flap support pins
- High lift systems (flaps and slats)
- Hydraulic actuators
- Engine parts (rotating hardware including bearings, shafts, rotors and smaller hardware)
- Pinion gears
- Shaft seal and bearing surfaces
- Torque tubes and pins
- Undercarriage/landing gear and control components
- Wheel axles, pins or rods of hydraulic actuators

**Industrial Diamond**
- Innovative new coating for bonding of TSP (thermally stable polycrystalline) diamonds

**Precision Engineering**
- Airport X-ray screening machine components
- Complex 3D printed components
- Construction equipment high-wear parts
- Helicoil inserts
- High pressure cylinder adaptors
- Hydraulic manifold blocks
- Hydraulic cylinders and pistons
- IGT & steam turbine compressor blades and vanes
- Injection moulding tooling
- Linear motor drive screws
- Motorsport components
- Plastics extrusion feeder screws and die plates
- Satellite protection systems
- Seal sleeves
- Silicon wafer production
- Textile feed mechanisms
- Transmission components
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