

# THERMAL SPRAY COATING TECHNOLOGY TO PROTECT AND REFURBISH VALVES

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THERMASPRAY

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## CORROSION AND WEAR IN VALVES

Valves used in the mining, petrochemical and chemical industries are often exposed to corrosive fluids containing wear particles. Abrasion wear damage occurs when particles are trapped between rotating and stationary surfaces, and erosion wear damage occurs when particles with high velocities impact on the exposed surfaces. The corrosion and wear of the critical surface leads to degradation of the valve performance, requiring frequent replacement or repair of valve components.

### Typical damaging mechanisms associated with valves:

- Corrosion such as: erosion corrosion and galvanic corrosion
- Environment - assisted cracking such as: caustic stress corrosion cracking and chloride stress corrosion cracking
- Mechanical and metallurgical failure mechanisms such as: adhesion, galling or scuffing, cavitation, corrosion fatigue, high / low stress abrasion and thermal shock

## PROTECTING THE SURFACE

Surface coatings such as plating and weld hardfacing have long been used to protect valve components from wear. These processes are however largely limited to nickel or chrome in plating, and Stellite 6 (Co-CrWC alloy) in weld hardfacing. The limitations with the plating processes are that they are not environmentally friendly (disposal of hazardous waste is difficult and expensive) and produce coatings with small interlinking microcracks that leads to corrosive media reaching and corroding the substrate leading to coating failure. An alternative process for producing wear resistant coatings on valve components is through the thermal spray process (commonly known as metal spray), and many

imported valves make use of this technology. Thermal spray technology has developed rapidly during the last few years, and the state-of-the-art high-velocity oxy-fuel (HVOF) process makes it possible to produce very dense and hard coatings with excellent coating adhesion.

Welding/cladding is complementary to the thermal coating process and Thermaspray specialises in applying advance weld hardfacing and cladding using the Plasma Transferred Arc (PTA) process. Plasma Transferred Arc (PTA) cladding is a hardfacing and cladding process which produces a coalescence of metals by heating them by means of a constricted arc between an electrode and the work piece. Shielding is obtained from the hot ionized gas issuing from the orifice which may be supplemented by an auxiliary source of shielding gas (inert gas or a mixture of gases).

### The advantages of PTA cladding compared to conventional arc weld hardfacing technologies is that:

- PTA weld/clad deposits are characterised by low levels of inclusions, oxides and discontinuities
- The weld hardfacing will closely mimic the corrosion resistance of the equivalent monolithic alloy.
- The careful control of heat input makes it possible to control weld dilution to <5%, which is critical for many high-performance alloys.

## ADVANTAGE OF THERMAL SPRAY TECHNOLOGY

One of the many advantages of thermal spray technology is the ability to produce carbide-based coatings. The carbides (many people refer to them as tungsten carbides [WC] or tungsten, but there is a wide range of carbides) are a unique family of materials that combine the hardness of a ceramic (from the hard metal carbides) with the toughness of a metal (carbide particles are "glued" together with a metal matrix). Carbide coatings combine excellent wear properties with good corrosion resistance. Because spraying parameters, like standoff distance and spray angle are very important in controlling the coating quality, the use of robotic manipulation for spraying complex components such as ball and butterfly valves is important to ensure that the coating quality and uniformity can be precisely controlled. Furthermore, specialised grinding techniques are required to grind these very hard materials to the fine finishes and tolerances required.

## OUR PARTNERS

Oerlikon Metco (technology partner), TWI-UK (industrial partner)



## THERMASPRAY VALVEMAX COATING RANGE

ValveMax range of coatings is propriety coatings developed by Thermaspray. All the ValveMax coatings are applied at Thermaspray's ISO 9001:2008 certified thermal spray coating facility using state-of-the-art thermal spray technology with six-axis robotic gun control.

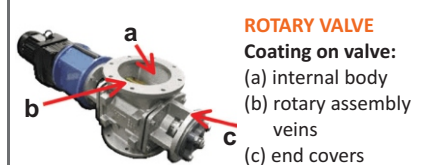
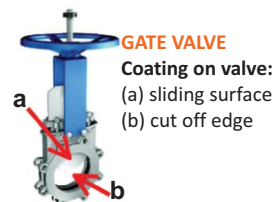
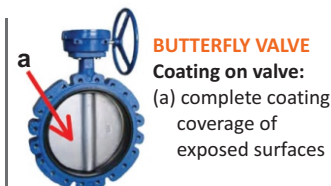
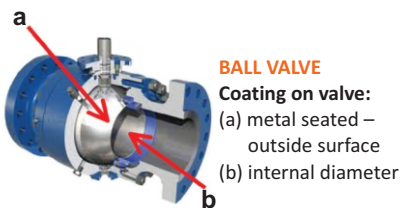
THE IMPORTANT PROPERTIES OF THE VALVEMAX RANGE OF COATINGS, COMPARED TO HARD CHROME PLATING ARE SUMMARIZED IN THE FOLLOWING TABLE:

Properties	Hard Chromium Plating	ValveMax S6	ValveMax NICR	ValveMax CRC	ValveMax WC
Performance parameters					
<b>Wear resistance</b>	Reasonable	Reasonable	Good	Very good	Excellent
<b>Corrosion resistance</b>	Poor	Reasonable	Good	Very good	Good
<b>Impact resistance</b>	Poor	Excellent	Reasonable	Reasonable	Reasonable

## VALVE APPLICATIONS

Thermaspray has extensive experience in the coating of rotary, butterfly, ball and gate valve components, as well as in the manufacture of replacement valve spares.

Valve Type	HVOF			Plasma		PTA Stellite
	Tungsten Carbide	Chrome Carbide	Inconel Spray	Chrome Oxide	Chrome Carbide – Nickel Chrome	
<b>Butterfly</b>	<b>x</b>	<b>x</b>				
<b>Ball</b>	<b>x</b>		<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>Knife Gate / Blade</b>	<b>x</b>					<b>x</b>
<b>Rotary</b>		<b>x</b>	<b>x</b>			<b>x</b>



## ABOUT THERMASPRAY

Thermaspray's core business is the supply of wear- and corrosion- resistant thermal spray coatings and PTA cladding to Original Equipment Manufacturers (OEMs) and end-users specification. Thermaspray's excellent standards of expertise and proven reputation are the reasons why our customers trust our precision engineering capabilities and skill set to provide solutions tailored to their requirements.

Thermaspray offers the following specialist services:

- **Thermal Spray Coating Processes:**
  - High Velocity Oxy-Fuel (HVOF), High-Pressure High Velocity Oxy-Fuel (HP-HVOF)
  - Plasma spray, Electric arc spray, Combustion wire spray, Powder flame spray
  - Spray and fuse
  - All spraying is performed using 6-axis robotic gun manipulation to ensure absolute process control and repeatability
- **Finishing Capabilities include:**
  - Machining, Probe Track Burnishing, Grinding (traditional and diamond), Finishing and Super-finishing, Linishing and Electrical run-out measurements/reporting
- **PTA cladding services**
- **Laser cladding (Technology partner with Oerlikon Metco)**
- **Refurbishment**
  - Thermaspray's in-house metallurgical laboratory is the only dedicated facility of its kind in South Africa's thermal spray industry - it sets us apart from competitor companies - underpins all our activities in terms of quality control and enables us to undertake world-class development
  - Our technology partner, TWI in the UK, assists us in coating quality evaluations and characterisation, cost reduction programmes, consultation with regards to surface engineering and thermal spraying, and coating advice for different applications
  - For OEMs and end-users alike, a suitably selected and correctly applied surface coating - metal, alloy, ceramic or carbide - can be a powerful tool in improving the performance of parts and extending their service life