THERMASPRAY	TECHNICAL BULLETIN	VALVEMAX

Thermal Spray Coating Technology to Protect Valve Components Operating in Severe-Service Applications

Technical Bulletin Ver.1
Revision: March 2013

Wear in Valves

Valves used in the mining, petrochemical and chemical industries are often exposed to corrosive fluids containing hard particles in suspension. In these severe service applications the valve components are subjected to sliding wear, abrasion wear (due to particles trapped between rotating and stationery surface), and erosion wear (due to high velocity 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.

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, limited to nickel or chrome in plating, and Stellite's (Co-CrWC alloy) in weld hardfacing. An alternative process for producing wear-resistant coatings on valve components is through the use of the thermal spray process (commonly known as metal spray). Many imported valves make use of this technology. Thermal spray technology has rapidly developed 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.

The major advantage of thermal spray technology is the ability to spray carbide-based coatings. The carbides (many people know them as tungsten carbides [WC] or tungsten) 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 closely controlled. Furthermore, specialized grinding techniques are required to grind these very hard materials to the fine finishes required.

Comparison with Hardchrome

To compare the corrosion resistance of the Valvemax range of thermal spray coating with hardchome, Thermaspray submitted several different coatings for testing at SABS (see report 5536/1288317/S208A.) The corrosion tests were performed according to SABS ISO 7253:1996, and in summary the hardchrome started showing corrosion damage after less than 100 hours, and complete failure occurred after less than 500 hours. In comparison, all the thermal spray coatings were in excellent condition with no corrosion damage at the end of the same test periods, indicating that a suitable thermal spray coating has significantly better corrosion resistance than hardchrome, as has been widely reported in the literature.

Thermaspray has extensive experience in the coating of control, butterfly, ball, rotary and gate valve components, as well as in the manufacture of replacement valve spares. 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 and six-axis robotic gun control.

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Thermaspray ValveMax Coating Range

The important properties of the Valvemax range of coatings are summarized in the following table:

Properties	Hard chromium	ValveMax S6	ValveMax NICR	ValveMax CRC	ValveMax WC
Composition	Cr	Co-CrWC (i.e. Stellite 6)	Ni-CrBC	CrC-NiCr	WC-CoCr
Process	Plating	PTA[1]	HVOF[2]	HVOF	HVOF
Microhardness [HV]	900	460	560	890	1300
Max service temp. [°C]		600	600	800	480
Performance Parameters					
Wear resistance	Reasonable	Reasonable	Good	Very good	Excellent
Corrosion resistance	Poor	Reasonable	Good	Very good	Good
Impact resistance	Poor	Excellent	Reasonable	Reasonable	Reasonable

1. Plasma Transferred Arc (PTA)

2. High Velocity Oxy-Fuel (HVOF)

Please contact Thermaspray to discuss your specific requirements and the proven solutions we can offer you.