

Optimised PTA hardfacing process

Thermaspray, South Africa's market leader in surface engineering and thermal spray coating technology, has optimised the parameters of its plasma transferred arc (PTA) coating process to ensure high quality, crack-free Stellite™ hardfacing deposits on a wide range of substrates.



Shaik Hoosain in Thermaspray's in-house European-approved metallurgical laboratory, the only dedicated facility of its kind in Africa's thermal spray industry.

Weld deposits of hardfacing alloys are commonly employed to increase the service life of components that are subject to abrasive wear and corrosion. Properties in the deposits vary and, generally, greater life is achieved with deposits of higher hardness, typically with hard carbides in the matrix.

Hard carbides, however, have a tendency to cause cracking in the deposit on cooling. Because this cracking does not significantly reduce the service life of the component, it is sometimes seen as advantageous in reducing residual stresses in the surface deposit.

But, as Shaik Hoosain, metallurgical engineer at Thermaspray points out: "In many instances, cracking, whether to obtain a sealing surface or to prevent fatigue failure, is undesirable. Cracking in Stellite hardfacing alloys is, essentially, related to the very high strength and low tensile ductility of the weld deposit – and its sensitivity to dilution," he explains. "To avoid cracking in these hardfacing deposits, it is essential to control or adjust parameters. We have, therefore, developed welding procedures for our PTA process that are strictly controlled to ensure high hardness Stellite deposits that are free from cracks and flaws," he assures.

Outlining the PTA process, Hoosain explains that this hardfacing procedure heats metal powders, which are blended by means of the constriction associated with the plasma arc. "It is a versatile method of depositing high quality, metallurgically fused deposits

on relatively low cost substrates," he informs *African Fusion*.

The PTA process was first introduced to the welding industry in 1964 as a method of bringing better control to the arc welding processes in the lower current ranges – and is complimentary to both thermal spray and conventional fusion welding. "PTA is mainly used on components that are subjected to severe corrosion or abrasion; thermal shock; slurry erosion; or extreme impact forces. The process gives the necessary protection to the substrate by providing a coating that can withstand these conditions," Hoosain says, adding, "PTA can be applied in practically every case where hardfacing solutions are needed."

Cracking in the subsequent deposits result from unequal cooling rates within the deposit and the expansion mismatch between the substrate and the weld. Thermaspray has addressed this through the dilution of the Stellite by a steel substrate, which results in a reduction of compositional mismatch, making a more ductile weld deposit by decreasing the carbide content. Furthermore, as more low-dilution, high-hardness layers are deposited, the sensitivity to cracking can be further reduced through correct preheating procedures and current level/heat input control.

"The cracking risk is also influenced by preheat levels and ensuing cooling rates. Here, it is most critical to carefully control the heat input, which makes it possible to control weld dilution to less than 5%, which is crucial for many

high-performance alloys," says Hoosain.

There are a number of important advantages of the PTA process compared to conventional arc welding processes. These include:

- Precise control of important welding parameters and a high degree of consistency.
- Controlled heat input, at lower levels than those associated with conventional arc welding processes, ensures weld dilution can be controlled to between 5.0 and 7.0%.
- Weld deposits are characterised by low levels of inclusions, oxides and discontinuities.
- The weld hardfacing layer closely mimics the corrosion resistance of the equivalent alloy.

Thermaspray, ISO 9001 accredited and an Eskom level 1 approved supplier of coatings and PTA solutions, has conducted several welding qualification procedures on various material substrates.

In a joint venture with Surcotec, Thermaspray offers an extensive portfolio of engineering and thermal spray coating solutions that extend component life, which assist OEMs and end-user clients across southern Africa to reduce costs and increase production.

Based in Gauteng and the Western Cape respectively, Thermaspray and Surcotec's world-class quality, wear- and corrosion-resistant thermal spray coatings, PTA cladding and polymer coatings – in partnership with Plasma Coatings USA and Diamant Metalplastic Germany – are augmented by a host of specialised allied services. These include coating finishing technologies such as machining, grinding, diamond grinding, probe track burnishing, electrical run out measurements and reporting, finishing, and super finishing.

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A PTA-applied hardfacing coating on a high temperature steam valve components.