THERMASPRAY

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Thermal spray coatings from Thermaspray – when only the best will do

It is imperative that thermal spray coatings, which are used to address an ever-increasing variety of surfacing needs, adhere to strict quality standards due to the criticality of industrial components.

"While good quality coatings extend component life, reduce costs and improve productivity on the one hand, bad quality coatings on the other hand can cause components to delaminate, crack, or spall during operation," explains Dr. Jan Lourens, Managing Director of South Africa's thermal spray and plasma coating specialist company, Thermaspray. "With implications of costly unplanned downtime, maintenance costs and reduced production, the importance of high quality thermal sprayed coatings cannot be overemphasised."

The microstructure of a thermally sprayed coating is characterised by the existence of various pores, micro-cracks, splat boundaries, oxides, grit entrapment, and unmelted particles. These attributes greatly affect the mechanical properties of a thermally sprayed coating. In general, an inhomogeneous microstructure reduces the overall stiffness, coating strength, and integrity. Coating characteristics such as porosity, cohesion, and oxide content all play a role in the quality of a coating.

Thermaspray remains at the forefront of the thermal spray coating industry in South Africa and boasts the only metallurgical laboratory in Southern Africa dedicated to the evaluation of thermal sprayed coatings. In partnership with Oerlikon Metco (formerly Sulzer Metco) and UK-based TWI (The Welding Institute), Thermaspray has developed techniques specifically tailored to evaluate the quality of thermally sprayed coatings.

2/…Thermal spray coatings from Thermaspray

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2/… Thermal spray coatings from Thermaspray

A coating is produced by a process in which molten or softened particles are applied by impact onto a substrate. A common feature of all thermal spray coatings is their lenticular or lamellar grain structure resulting from the rapid solidification of small globules, flattened from striking a cold surface at high velocities.

Several key processing steps are required to produce optimal thermal sprayed coatings. To ensure adequate bonding of a coating material, the substrate must be properly prepared through cleaning, followed by roughening usually through grit blasting. Masking and heating are commonly applied to the substrate prior to thermal spraying. Coating quality also depends on spray process variables such as part temperature control, gun and substrate motion, spray pattern, deposition efficiency and deposition rate. Post-coating operations which include finishing treatments such as grinding, polishing and densification treatments (fusion, testing and inspection) further enhance the quality of the coatings.

Typical examples of poor coating quality include:

- A coating with lack of adhesion and cohesion leads to flaking and peeling during in-service operations.
- A coating with foreign particles entrapped in the coating leads to poor cohesion, flaking and peeling during in-service operations.
- A coating with excessive grit entrapment leads to poor adhesion to the substrate causing undue stress in the material leading to cracks or weak points in the coating that will serve as points of attack in corrosive and abrasive environments.
- Coatings with oxide inclusions lead to the added hardness of the coating which in turn leads to brittle coatings as oxides fracture easily. If these strings are too concentrated it will lead to a decrease in cohesive strength of the coating.
- One of the most common causes of porosity, another important factor that influences coating properties, is the presence of unmelted particles.

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These solid particles, some of which are reflected from the coating surface, may adhere to or become trapped in the rough finish of the coating.

These particles are not well bonded nor are they in intimate contact with the underlying splat which creates voids and porosity. Excessive porosity creates poor cohesion and allows for higher wear and corrosion rates. Poor cohesion can lead to cracking, delamination, and spalling.

With a highly skilled, qualified staff, state-of-the-art equipment and a dedicated metallurgical laboratory, Thermaspray is able to ensure that coatings are of the highest standards and quality by adhering to strict standards in its coating process and quality evaluation. /Ends

Photo captions:

1. Thermaspray coating quality - a microstructure of a Thermaspray coating showing no defects (cracks, unmelted particles, oxides) and minimal porosity.
2. Thermaspray coating quality - no grit entrapment, ensuring maximum adhesion to the substrate.

References

1. Thermaspray (Pty) Ltd internal documents
2. www.twi-global.com
3. www.gordonengland.co.uk

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