Revestimentos resistentes à corrosão aplicados à superfície por aspersão “fria”

Corrosion-resistant coatings applied to the surface by cold gas spray

A. V. Benedetti[1], F. S. da Silva[1], I. G. Cano[2] and J. M. Guilemany[2]
[1]UNESP - São Paulo State University - Institute of Chemistry, Araraquara - Brazil
[2]Thermal Spray Center - University of Barcelona, Barcelona - Spain

Abstract: Cold Gas Spray (CGS) has emerged in the field of surface engineering in the mid-1980s as a new process of high performance and low cost to obtain coatings with large thickness, good adhesion, low oxidation, high resistance to corrosion and wear. The underlying principle of cold spraying is that the sprayed material is no longer heated, semi-molten or fully molten as in Plasma, High Velocity Oxygen Fuel (HVOF) or other thermal spray techniques, to be stuck on the substrate surface [1]. Instead, solid state powders are accelerated in a high-pressure supersonic gas jet that allows the particles to be plastically deformed during impact with the target to form interconnected splats adhered to the substrate, resulting an overlay deposit [2]. A wide range of materials can be sprayed by CGS as metallic, plastic, composites and others with a particle size in the range of 5-400 µm [2,3]. The temperature, pressure, particle size and nature of the carrier gas, are spraying parameters with mostly influence on the microstructure, corrosion performance and wear resistance of the coatings. Under optimized parameters, CGS coatings have a dense microstructure in which the particles are strongly deformed, almost oxides free and without cracking and interconnected porosity. The porosity can reach at values less than 1% and the coatings thicknesses are between 0.2-25 mm. Taking account the microstructure characteristics, the CGS coatings show a high corrosion resistance in chloride medium during long immersion times (t>3000 h) [3]. Electrochemical techniques have been widely used to investigate the corrosion resistance of these coatings, mainly electrochemical impedance spectroscopy (EIS) and open circuit potential (EOCP), since they allow to investigate the corrosion resistance during long immersion times. Furthermore, these electrochemical techniques allow proposing corrosion mechanisms that have been used to improve the development of coatings with higher performance. Specific industrial applications of these coatings against corrosion occur on different fields such as energy, naval, aircraft and automotive [2,3]. Furthermore, CGS offers the possibility to produce coatings with higher corrosion and wear resistance, almost without environmental impact or toxic waste production.

Acknowledgements: CNPq (Procs. 153177/2014-4 and 201325/2014-4), and PNPD CAPES for financial support and scholarships.

References:

[1] Sovolev, V., Guilemany, J. M., Nutting, J. High velocity oxy-fuel spraying. London: Maney, 2004.
[2] S. Yin, P. Cavaliere, B. Aldwell, R. Jenkins, H. Liao, W. Li, R. Lupoi, Cold spray additive manufacturing and repair: Fundamentals and applications, Additive Manufacturing 21 (2018) 628–650.
[3] F. S. da Silva, N. Cinca, S. Dosta, I. G. Cano, J. M. Guilemany, A. V. Benedetti Cold gas spray coatings: basic principles, corrosion protection and applications. Eclética Química. 42 (2017) 09-32.

* **e-mail of corresponding author:** assis.v.benedetti@unesp.br