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Chlorine-Induced High Temperature Corrosion of Inconel 625 Sprayed Coatings Deposited with Different Thermal Spray Techniques

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Abstract

Ni-based coatings of the type Inconel 625 sprayed with high-kinetic spray processes are applied as protective coatings in many industrial fields where high corrosion resistance is required. High-Velocity Oxygen-Fuel (HVOF) and arc spray are common thermal spray methods used in the industry of power generation. Conversely, High-Velocity Air-Fuel (HVAF) and cold spray are nowadays technologies of rising interest because of their possibilities to create highly dense and low oxidised metallic coatings. This study aims to assess the effect of the different high-kinetic spray systems on chlorine-induced high temperature corrosion protection of Inconel 625 coatings. The coatings were exposed for 168 h to the test condition of 550°C under KCl salt deposits in 12% humidity air atmosphere. All the coatings provided effective protection to the substrate with the HVOF and arc sprayed coatings being the most resistant. The coatings were subjected to chlorine induced active oxidation and showed the typical layered structure of the external oxide deposit with chlorine detected at the coating/oxide interfaces. Signs of internal degradation were observed and were attributed to the penetration of chlorine through particle and splat boundaries. Chlorine was detected in some cases up to a depth of 200µm from the surface.