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Effect of nanostructured zirconia additions on the microstructure and wear resistance of nickel-based alloy coatings deposited by APS Plasma Spraying

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Nickel hardfacing alloys have become increasingly popular in recent years in protection of surfaces, owing to their excellent performance under conditions of abrasion and corrosion at high temperature. The microstructure and mechanical properties of Ni-based hardfacing alloy deposits has been studied using various alloys compositions and dissimilar thermal spraying and welding processes. However, in the literature there are no references concerning the effect of zirconia additions on the properties of this type of coatings. The aim of the present investigation is to study the effect of nanostructured zirconia additions on microstructure, hardness and wear performance of a nickel-based hardfacing alloy deposit on stainless steel by Atmospheric Plasma Spraying (APS). The coatings with nanostructured zirconia additions were produced using powders prepared by mechanical alloying and using a dual system of powder injection available at the APS equipment. The microstructure, the mechanical properties and the tribological properties were characterized by scanning electron microscopy/energy dispersive X-ray analyses (SEM-EDAX), X-ray diffraction (XRD), scratch testing, Vickers indentation and reciprocating sliding wear tests. All the properties of the deposits were compared with coatings containing pure nickel based alloy and nanostructured zirconia. The results showed that the coatings with nanostructured zirconia additions display high levels of porosity and excellent adhesion to the substrate. The deposits performed with the dual system of powder injection revealed some improvements in the mechanical properties. According with sliding tests, the additions of nanostructured zirconia increases the wear resistance of the coatings and decreases its friction coefficient.

Keywords
Plasma Spraying
Ni-based alloy
Nanostructured zirconia additions