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Topographic, optical and chemical properties of zinc particle coatings deposited by means of atmospheric pressure plasma

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Abstract

In this research, topographic, optical and chemical properties of zinc oxide layers deposited by a cold plasma-spray process were measured. Here, zinc micro particles were fed to the afterglow of a plasma spark discharge whereas the substrates were placed in a quite cold zone of the effluent plasma jet. In this vein, almost closed layers were realised on different samples. As ascertained by laser scanning and atomic force microscopic measurements the particle size of the basic layer is in the nanometre scale. Additionally, larger particles and agglomerates were found on its top. The results indicate a partial plasma-induced diminishment of the initial particles, most probably due to melting or vaporisation. It is further shown that the plasma gives rise to an increased oxidation of such particles as confirmed by X-ray photoelectron spectroscopy. Quantitative analysis of the resulting mixed layer was performed. It is shown that the deposited layers consist of zinc oxide and elemental zinc in approximately equal shares. In addition, the layer's band gap energy was determined by spectroscopic analysis. Here, considerable UV blocking properties of the deposited layers were observed. Possible underlying effects as well as potential applications are presented.

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