Plasma spray deposition of metal oxide and carbon containing coatings for wide range application

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Abstract

New achievements in the research of two-phase high temperature gaseous and plasma flows containing incandesced and accelerated dispersed particles allowed the deposition of high quality, well adhered catalytic and tribological coatings for wide range applications. Using nonequilibrium plasma spraying technology novel compositional coatings were formed on metal, ceramic or other surfaces.

Several kinds of plasma spray deposition systems with linear DC plasma torches 5 – 90 kW of power operating at atmospheric and reduced pressure, have been developed and employed in the Plasma Processing Laboratory of Lithuanian Energy Institute. The mixture of argon, hydrogen, nitrogen were used as plasma forming gas, acetylene and propane-butane were used as precursors.

The sublayers of coatings has been formed from mixtures of Al, Ni and $Al(OH)_3$. The main active layers of catalytic coatings were made from mixtures of $Al(OH)_3$ doped with copper, chromium, vanadium or zirconium oxides. Tribological and biocompatible coatings were deposited employing yttria stabilized zirconia (YSZ), Al_2O_3, dolomite, SiO_2, etc.

Much attention has been focused on the deposition and investigation of amorphous carbon films. The synthesis of hard coatings includes experience of the fabrication of specific equipment for deposition of diamond like carbon and related carbide coatings by direct ion beam. In such a way hard, chemically, wear and radiation resistant, thermally conductive coatings have been produced.

This report contains also information on the effect of plasma jet parameters, the distance between plasma source and substrate, the inlet location of dispersed particles, etc., on the quality and properties of coatings.

Keywords: Atmospheric pressure plasma, coatings deposition, plasma torch, plasma technology.