

Fracture Strength of Carbon Nanotube Reinforced Plasma Sprayed Aluminum Oxide Coating

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Abstract : Carbon nanotube (CNT) reinforced aluminum oxide (Al₂O₃) composite coating was synthesized on the steel substrate using plasma spraying technique. Three different compositions of coating such as Al₂O₃, Al₂O₃-3-4 wt. % CNT and Al₂O₃-8 wt. % CNT were synthesized and the fracture strength was determined using the four point bend test. Uniform dispersion of CNTs over Al₂O₃ powder particle was successfully achieved. With increasing CNT content, porosity in the coating showed decreasing trend and hence contributed towards enhanced mechanical properties such as hardness (~12% increased) and elastic modulus (~34 % increased). Fracture strength of the coating was found to be increasing with the CNT additions. By reinforcement of 8 wt. % of CNT, fracture strength increased by ~2.5 times. The improvement in fracture strength of Al₂O₃-CNT coating was attributed to three competitive phenomena viz. (i) lower porosity (ii) higher hardness and elastic modulus (iii) CNT bridging between splats.

Keywords : aluminum oxide, carbon nanotube, fracture strength, plasma spraying

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