Surface and Coatings Technology

Volume 333, Issue 1, 2018, Pages 13-23

Thermal spray metallisation of carbon fibre reinforced polymer composites Effect of top surface modification on coating adhesion and mechanical properties

A. REZZOUG, S. ABDI, A. KACI, M. YANDOUZI

Abstract: Thermal Spray TS processes are used to enhance the surface properties of Polymer Matrix Composites. However, poor adhesion and mechanical degradation are usually experienced. The main objective of this work is to investigate the effect of the modification of the top surface of Carbon Fibre Reinforced Polymer CFRP substrate on the TS deposition of metallic coatings. CFRP composite panels were manufactured with different upper layers I pure epoxy overflow layer, II pure copper powder filler layer, III mixture copper and stainless steel powder filler layer, and IV aluminium mesh layer. The top layers of the CFRP substrates were manufactured during the forming process. Arc Spray, one of the TS processes, was used to deposit zinc coating onto the manufactured CFRP panels. The substrates were sandblasted before the TS process to enhance the adhesion of the deposited zinc to the substrate. The quality of the coatings including adhesion and mechanical properties was investigated using tensile adhesion and bending test, respectively. The porosity, microstructure, morphology and surface fracture of the metallised CFRP coupons were characterized using optical and electronical microscopy techniques. The results obtained revealed that pure epoxy top layer did not resist to sandblasting prior to TS process, contrary to the substrates with fillers and mesh top layer. Moreover, the aluminium based mesh layer improved the adhesion strength by about 50 percent. Bending test results indicated that coating on CFRP composites decreased their mechanical properties. However, the use of a metallic mesh layer reduced the degradation effect of spraying.

Keywords : CFRP composite, Zn coating, Arc spray, Filler layer, Adhesion strength