

The Effect of Carbon Nanotubes in Copolyamide Nonwovens on the Properties of CFRP Laminates

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Abstract : In recent years there has been increasing interest in many industries, such as the aviation, automotive, and military industries, in Carbon Fibre Reinforced Polymers (CFRP). This is because of the excellent properties of CFRP, which are characterized by very high strength and stiffness in relation to their mass, low density (almost twice as low as aluminum and more than five times as low as steel), and corrosion resistance. However, they do not have sufficient electrical conductivity, which is required in some applications. Therefore, work is underway to improve their electrical conductivity, for example, by incorporating carbon nanotubes (CNTs) into the CFRP structure. CNTs possess excellent properties, such as high electrical conductivity, high aspect ratio, high Young's modulus, and high tensile strength. An idea developed by our team is a modification of CFRP by the use of thermoplastic nonwovens containing CNTs. Nanocomposite fibers were made from three different masterbatches differing in the content of multi-wall carbon nanotubes, and then nonwovens that differed in areal weight were produced using a thermo-press. The out of autoclave method was used to fabricate the laminates from commercial carbon-epoxy prepreg dedicated to aviation applications - one without the nonwovens (reference) and five containing nonwovens placed between each prepreg layer. The volume of electrical conductivity of the manufactured laminates was measured in three directions. In order to investigate the adhesion between carbon fibers and nonwovens, the microstructure of the produced laminates was observed. The mechanical properties of the CFRP composites were measured in a short-beam shear test. In addition, the influence of thermoplastic nonwovens on the thermos-mechanical properties of laminates was analyzed by Dynamic Mechanical Analysis. The studies were carried out within grant no. DOB-1-3/1/PS/2014 financed by the National Centre for Research and Development in Poland.

Keywords : CFRP, thermoplastic nonwovens, carbon nanotubes, electrical conductivity

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