

ADVITAC: Multifunctional composite aerostructures

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Abstract

The work presented here is part of the FP7 project ADVITAC, which addresses the design and manufacture of a composite tailcone. The new design incorporates multifunctional material aspects such as enhanced surface and bulk electrical conductivity as well as fire resistance. These are achieved via the incorporation of nanoparticles in the resin matrix of the composite and the integration of high conductivity and/or fire retardant surface layers in the laminate.

The enhancement of the electrical behaviour of the material is achieved by using carbon nanotubes in the form of a suspension in the liquid epoxy resin for improvement of the bulk resin properties and in the form of buckypaper for the improvement of the surface properties. The challenges related to these technologies concern the production of high quality buckypapers in sizes compatible with the design of the part, the efficient dispersion of carbon nanotubes in high temperature monocomponent aerospace epoxies and the modification of conventional liquid moulding processing to allow for the incorporation of buckypapers and to cope with the modified rheological behaviour of the nanotube loaded liquid resin. Evaluation of the electrical performance of the modified composites is based on low voltage DC and AC electrical measurements and lightning strike tests.

The fire resistance of the multifunctional composite is improved via the development of buckypaper combining nanofibres with nanoclays. The production of this hybrid barrier layer of the size required for the component is a major challenge.