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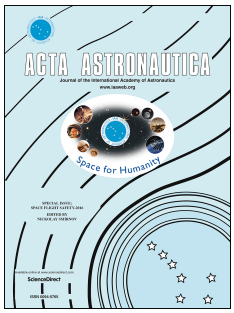

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Analysis of atomic oxygen and ultraviolet exposure effects on cycloaliphatic epoxy resins reinforced with octa-functional POSS.

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Abstract

In this study, novel nanocomposites were created by incorporation of Silsesquioxane containing eight glycidylether groups (octa-POSS) into a cycloaliphatic epoxy cured by an anhydride. The developed resin system, with different nanoparticle concentrations, was used on the outer layers of an ultra-thin CFRP structure in order to provide better environmental resistance to the environment of low Earth orbit (LEO) which was tested in a ground-simulation facility. The developed resins were subjected to space-like degrading factors and their response to corrosion, radiation and elevated temperatures was monitored by mass loss, together with measuring changes in surface chemistry (ATR-FTIR), functionality development (contact angle measurement and XPS), roughness (scanning laser microscopy) and morphology (SEM). The influence of increasing octa-POSS content on thermo-mechanical properties was measured with DMTA and the strength and modulus of elasticity were determined by flexural test. The addition of octa-POSS in any loading improves the environmental resistance, however, the most significant retention of mass and mechanical and surface properties after space-like exposure was observed in the 20 wt% octa-POSS reinforced cycloaliphatic epoxy. The results presented here may contribute to the development of novel class of nanocomposites which can offer an extended service life in LEO.

Keywords: Atomic oxygen, Cycloaliphatic epoxy resin, POSS, Space materials, UV radiation

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