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IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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NANOSILICA-BASED COMPOSITES FOR SPACE DURABILITY

Abstract

Research into new materials has become an important aspect of space technology due to the harsh, inhospitable and potentially dangerous environment in which materials operate. Before considering a material for space applications, it is important to carefully investigate conditions such as high temperature cycles, ultraviolet exposure and vacuum conditions. Due to their high specific mechanical performance and their low weight, composites are being used more and more for spacecraft. Epoxy is a highly popular resin that is typically combined with fibers or fillers to create specialized materials. Fillers are added to the resin in powder form before the curing phase to ensure even distribution throughout the volume and a proper incorporation into the material. This study investigates nanosilica-based composites and considers different loading percentages (0, 0.5, 1, 2, 5, 10, 15 wt %) to observe their effects on mechanical response under varying environmental conditions. Firstly, dynamic mechanical tests were conducted to characterize the viscoelastic behavior of doped and undoped samples. The tests were carried out over a temperature range of -100 to +150 C to simulate space conditions. Next, the tests were repeated, including a preliminary UV-C exposure phase. Subsequent cycles were applied to the material to evaluate its response. Finally, the study evaluated the combined effects of solar radiation and high vacuum on the materials. The results indicate that the hybrid composite enhances performance significantly compared to the neat material until a critical loading percentage is reached. From this point on, the filler behaves as an inclusion in the material with negative effects.