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WHIPPLE SHIELDING SPACECRAFT USING NI-TI SHAPE MEMORY ALLOY AND AEROGEL COMPOSITE

Abstract

In this paper, we present a novel concept for spacecraft shielding using amorphous Nickel-Titanium shape memory alloy (NiTi SMA) and Aerogel Composite Whipple shield structure. A couple of experiments have been performed on this Whipple shield structure which consists of aerogel composite, reinforced bumper and amorphous Nickel-Titanium shape memory alloy (NiTi SMA) rear wall, using a mini canon impacting velocities around 3km/s to 6km/s. The aerogel composite was stuffed in two places: one near the face of the rear wall, and the other in between the rear wall and the bumper. A dimensional investigation of the parameter included in the hypervelocity impact recorded that Whipple shield composited with aerogel composite and amorphous Nickel-Titanium shape memory alloy has high density, good thermal insulation and weighs lighter as compared to other material, which is helpful for better performance of the new shields. Also, for the wear and tear of material, a two-way memory effect has been used which will repair the damage caused by the impact by regaining its original shape. Hence, our initial research demonstrates some assured shreds of evidence that the new Whipple shield structure can provide more advanced protection than the long-established shields.