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STRUCTURAL DESIGN AND SIMULATION OF SPACE DEBRIS IMPACTING COMPOUND SHIELD IN HIGH VELOCITY

Abstract

In order to enhance the protection capability of spacecraft impacted by high velocity debris in ballistic range from 1.3 to 3.0km/s, the protecting effect of the same Whipple shield, impacted in ballistic range at 2.8km/s and 6.5km/s in shatter range, were compared by ballistic limit curve. It was validated in Autodyn software with Smoothed Particle Hydrodynamics. Based on the typical Whipple shield,ceramic-aluminum alloy compound shield was built by importing the ceramic material to the rear wall. Protecting effect of aluminum oxide and boron carbide ceramic compound rear wall with three different thickness ratios, impacted by a sphere projectile at 2.8km/s, were compared by numerical simulation. Research showed that, in certain velocity range, the same Whipple shield had a good effect on the velocity in shatter range but possessed few function on ballistic range. Ceramic-aluminum alloy compound shield, with some attained optimal thickness ratios, could increase the protection capability of the shield impacted with high velocity in ballistic range. It has some advantages to use boron carbide ceramic in order to decrease the total mass of satellite and protecting structure.