

SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

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EXPERIMENTAL AND NUMERICAL INVESTIGATIONS OF STUFFED WHIPPLE SHIELDS
PROTECTING CHINESE MANNED SPACECRAFT AGAINST ORBITAL DEBRIS

Abstract

With the worsening of the orbital debris environment, research on the orbital debris shielding attracts more and more interests of Chinese investigators. In this paper, experimental and numerical investigations of stuffed Whipple shields used to protecting Chinese manned spacecraft against orbital debris impact are introduced. Due to the development of high-strength, lightweight materials many years after the introduction of the Whipple shield, the basic Whipple shield was modified so that ceramic fibre sheets were placed between the bumper and rear wall to provide further protection which was named as stuffed Whipple shield. Stuffed Whipple shield will be adopted as orbital debris protecting structure on Chinese manned spacecraft, and its important parameters, viz. thickness of bumper, stuffed materials location and number of ceramic fibre sheets, are determined by experimental and numerical validations. Results indicate that stuffed Whipple shield performs better when the distance between stuffed materials and rear wall is 1/3 of that between bumper and rear wall and the thickness of bumper is 1.0mm. Furthermore, basaltic fabric is more efficient than aramid fabric in improving the capability of stuffed Whipple shield.