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

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PRELIMINARY STUDY ON THE PERFORMANCE OF SHIELDING CONFIGURATION WITH STUFFED LAYER UNDER HYPERVELOCITY IMPACT

Abstract

In order to study the cracking mechanism of stuffed shield configuration on the debris cloud and to develop stuffed shield configuration with better performance, hypervelocity impact tests on shield configuration with stuffed shield were carried out. Firstly, the hypervelocity impact test on the shield configuration with stuffed shield of 3 layer ceramic fiber and 3 layer aramid fiber were conducted. The study results show that the debris cloud generated by the aluminum sphere impacting on the bumper at the velocity of about 6.2km/s would be cracked by the stuffed shield configuration efficiently when the ceramic fiber layers and aramid fiber layers are jointed together, however, the shield performance would be reduced when the ceramic fiber layers and aramid fiber layers are separated by some distance. The mechanisms of stuffed shield cracking the debris cloud were analyzed according to the above test results. Secondly, based on the mechanism of the hypervelocity impact tests on three different stuffed shield configurations, i.e. 7 layer Basalt+7 layer Kevlar configuration, 14 layer configuration comprised by Basalt and Kevlar alternating in turn, and 7 layer Basalt+2mm-thick foam configuration, with the equivalent areal density to the 1mm-thick aluminum plate were also carried out to compare their performance of cracking debris cloud. The mechanisms of stuffed shield cracking the debris cloud were validated by the test results that provide reference for designing of high performance shield configuration with stuffed layer.