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OPTIMIZATION DESIGN OF STUFFED WHIPPLE SHIELD BASED ON RESPONSE SURFACE METHOD

Abstract

In the design process of space debris protection structure, the application of design equation can greatly reduce the iterative process and cost of design, and improve the design efficiency. For the stuffed whipple shield, NASA combined a large number of experiments and simulations to give a semi empirical design equation. Unfortunately, the equation did not optimize the position of the stuffed layer, but default to put it in the middle position. In this study, domestic high-performance SiC fiber cloth is used to replace Nextel. For the replaced shield, the optimization design of stuffed position, area density ratio of bumper and stuffed shield were carried out. By determining the optimal stuffed position and the area density distribution of bumper, SiC and Kevlar, the design equation is optimized and modified. Finally, the validity of the new design equation is verified by hypervelocity impact experiments, which provides guidance for the design of high-performance stuffed whipple shield.