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

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RESEARCH ON SHIELD FOR CHINA'S SPACE STATION FROM METEOROID AND ORBITAL DEBRIS

Abstract

Space station is the largest spacecraft being developed in China, which will be composed of three spacecrafts by docking on orbit. The station will be to stay aloft for more than a decade, and it will be visited by a series of Shenzhou and cargo spacecraft during its operational lifetime. The station will orbit about 400 km above the Earth's surface, and its risk of failure subjected to MOD is bigger than all others of China. According to the results of risk assessment, PNP of the station is almost 0 with no shield, and only 0.3 with Whipple. Therefore, advanced shield structures and materials will be adopted for China's space station. Stuffed whipple is employed in the higher risk part of ISS, and distance between stuffed materials and rear wall is half of standoff or about 1/3 of standoff. Thus, locations of the stuffed materials is preferred from among 2/3, 1/2 and 1/3 of standoff by HVI simulation and test. It becomes obvious that capability of stuffed whipple is best when stuffed materials is placed in 1/3 of standoff, secondly 1/2 of standoff, finally 2/3 of standoff. So the best will be adopted for the station. Basaltic fabric and aramid fabric will be adopted as stuffed materials for the station, area density of single basaltic fabric is 0.03216g/cm2, while single aramid fabric 0.01776g/cm2. Number of composite layers is studied by HVI test, according to the test results, critical diameter of aluminum projectile is about 5.0mm and 8.0mm respectively at 3.5km/s and 6.2km/s with regards to stuffed whipple with 3-layers basaltic and 3-layers aramid, while about 5.5mm and 8.5mm respectively at 3.5km/s and 6.2km/s with 4-layers basaltic and 3-layers aramid. Hereby, stuffed whipple can be designed to meet the protection requirement of the station.