

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

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DEBRIS DISPERSION EFFECT IN N-SHAPE SHIELD CONFIGURATION

Abstract

Based on the fact that the dispersion degree of the debris in oblique impact is higher than that in normal impact, a new triple-walls configuration named N-shape configuration with the middle wall obliquely placed is presented and studied in comparison with the normal triple-walls configuration. Hypervelocity impact tests and 3D numerical simulation (SPH) are carried out. Both of the two configurations are composed of the same material and possess the same area density and space. The dispersions of the debris clouds generated in projectile impacts and their damage to the rear wall are compared and analyzed. In hypervelocity tests with the normal triple-walls configuration, under the condition that the projectile diameter is 5.5mm and the impact velocity is 4.8km/s, there is a perforation with the diameter of about 2mm in the rear wall. However, there is no perforation in the rear wall of the N-shape configuration under the same impact conditions, but a debris dispersion area of an elliptic shape with the long side of 40mm and the short side of 34mm. The area of elliptic region is about 1068 mm² compared with the area of 660 mm² on the rear wall of the normal triple-walls configuration, so the damage energy density is smaller and the damage level of the rear wall is lower. Simulations according to the same impact parameters give results in consistency with the tests, that there is no perforation in the rear wall of the N-shape configuration, but a perforation in the rear wall of the normal triple-walls configuration, and the dispersion degree of impact debris in N-shape configuration is noticeable. In the range of 3km/s 7km/s, it is found that the dispersion degree of impact debris in N-shape configuration is significantly higher than that in normal triple-walls configuration. Under the impact parameters given in this paper, it is verified that the shield performance of the N-shape configuration is better than the normal triple-walls configuration with the same area density and space.