

Title: Ballistic Limit of CFRP Plates

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Abstract

JAXA has carried out the hypervelocity impact tests of carbon fiber reinforced plastic (CFRP) plates together with University of Padova. Quasi-isotropic CFRP plates of 2.3, 3.5, and 4.7 mm in thickness were tested. Aluminum sphere of 0.8 to 2.9 mm in diameter was used as projectiles. With a two-stage light gas gun, the projectile was launched with a velocity range of 2 to 5 km/sec in the normal direction to the CFRP plate. Since the perforated hole and the crater on the CFRP plate after the impact are filled with flakes of the carbon fiber, it is difficult to determine the perforation of the projectile. Therefore, whether the projectile perforated the CFRP plate or not was decided by the craters on a copper plate installed behind the CFRP plate. After the impact, peeling along the fiber direction was observed on the surface of the CFRP plate. Moreover, internal delamination was generated near the surface. Finally, a ballistic limit equation of CFRP plates of 2 to 5 mm in thickness was calculated on the basis of the Cour-Palais equation. The ballistic limit equation was in good agreement with the test results.

Keywords: Space Debris, CFRP, Hypervelocity Impact, Ballistic Limit Equation