

18th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Impact-Induced Mission Effects and Risk Assessments (3)

Author: Prof. Zizheng Gong

Beijing Institute of Spacecraft Environment Engineering, China Academy of Space Technology (CAST),
China, gongzz@263.net

SPHERICAL PROJECTILE WITH MILLIMETER SCALE OVER 10KM/S LAUNCHING BY SG-III
PROTOTYPE LASER FACILITY AND ITS IMPACT EFFECTS ANALYSIS

Abstract

The impact velocity of orbital debris on spacecraft can be reached 15 km/s. However, limited by the launching capability of two-stage light gas gun, the velocity in the performance of Whipple shields databases is always below 8 km/s. In this paper, we achieved the impact velocities above 10 km/s of spherical aluminum projectiles with 0.2-0.3 mm in diameter, by using high-power laser-driven method through China SG-III prototype laser facility. The hypervelocity impact experiments above 10 km/s are carried out for Whipple shields. The impact velocity of the projectiles is measured based on the images taken by streak camera. The damage characteristics on the rear wall was studied. The phenomena is different from normal impact event using two-stage light-gas gun, there are no obvious signs of a debris cloud. However, there is a distinct semi-spherical impact crater in the rear wall, it looks like a meteorite crater. This suggested that the projectile remain spherical completeness before impacting the target at such a high velocity, and it the experiment is repeatable. Our experiments and results demonstrate that the hypervelocity impacts test for spherical projectile with millimeter scale over 10km/s in laboratory is feasible.

Keywords: Hypervelocity launch, 10 km/s, Spherical projectile, laser-driven, impact effects over 10 km/s.