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NEW TECHNIQUE FOR LAUNCHING SPHERICAL PROJECTILE WITH MILLIMETER SCALE OVER 10 KM/S USING STRONG LASER-DRIVEN AND SOME EXPERIMENTS FOR WHIPPLE SHIELDS

Abstract

The impact velocities of debris on spacecraft can be reached 15 km/s. However, the velocity in the performance of Whipple shields databases is limited by the capability of two-stage light gas gun, the workhorses of hypervelocity impact research. Although other launchers can fire aluminum particles in excess of 10 km/s, test analysis is complicated by the fact that the projectiles are non-spherical and subject to variations in impact orientation, size and shape. In this paper, we demonstrate that impact velocities at 15 km/s can be achieved with aluminum projectiles of 0.2-0.3 mm in diameter using a high-power laser. The hypervelocity impact performance of a Whipple shield is investigated experimentally using laser-driven launchers at velocities of 10-15 km/s. The velocity of the projectiles is estimated based on the images taken by streak camera. A hypervelocity sequence laser shadowgraph imager is employed to record the debris cloud generated upon impact. The impact characteristics, including debris clouds, penetration holes in the bumper, and damage patterns on the rear wall are studied. Experimental study on this work is being carried out, and very optimistic about the prospects for the future. This will prove that we can simulate the hypervelocity impacts with velocities at 15 km/s in laboratories.