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EFFECTS OF TEMPERATURE OF TARGETS ON EJECTA SIZE DISTRIBUTION IN HYPERVELOCITY IMPACT

Abstract

Projectiles with low kinetic energy—those with small size or low velocity—do not perforate the bumpers and outer surfaces of spacecraft and space stations; instead, they form craters on these surfaces. In such cases, ejecta from the target surface and fragments of the projectile are scattered widely. These ejecta and fragments (known as secondary debris) become new debris. In low Earth orbit, the temperature of spacecraft and satellites varies from approximately -150°C to 200°C. Thus, we are interested in the effects of temperature of targets on ejecta composition and crater formation in thick aluminum alloy targets in hypervelocity impact. In this study, we investigated the influence of temperature on ejecta size distribution when 7-mm-diameter spheres (weight 0.51 g) made of aluminum alloy 2017-T4 struck aluminum alloy 6061-T6 targets in thickness of 30 mm, for impact velocities of 2-3 km/s, using a two-stage light-gas gun. The size distribution of ejecta collected from the test chamber was examined in detail. We observed the ejecta and crater lips using a scanning electron microscope and cracks near craters using X-ray computed tomography.