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Ejection Velocity and Angle of the Fast Ejecta from Impact of Small Bodies

Ayana Takabe[1], Akiko Nakamura[1*], Takekuni Katura[1], Susumu Takasawa[1], Masato Setoh[1], Sunao Hasegawa[2]

[1]Kobe University, [2]ISAS/JAXA

Ejection from impact between solid projectiles and targets has been investigated in laboratory with focus on the relationships between ejecta velocity and position and ejecta velocity and mass. Based on the laboratory data, the ejecta scaling laws are proposed. However, little is understood for relations of ejecta velocity and ejection angle versus impact velocity and impacting bodies.

We conducted impact experiments using two-stage light-gas guns at ISAS. We used rocks and nylon blocks which are easier to be vaporized. Projectile materials were metals, glass, and nylon. We took images of pre- and post impact using two high-speed cameras. Ejecta velocity and ejection angle measured from the surface normal to the targets were investigated on the images.

We found that the maximum ejection velocity increases with the initial shock pressure and is dependent upon projectile materials. There are no difference between the ejection velocity from the serpentine blocks and dunite rocks, i.e., no effect of dehydration of serpentine was found on the velocity of the fastest ejecta. Ejecta from the shots with nylon projectiles were faster than the theoretical limit of the solid ejecta. It suggests that nylon vapor probably accelerates the solid ejecta. The ejection angle decreases with initial shock pressure for some projectiles.

Keywords: small bodies, impact, ejecta, velocity