Scaling of oblique impact cratering onto inclined granular layer

Shinta Takizawa¹, *Hiroaki Katsuragi¹

1. Graduate School of Environmental Studies, Nagoya University

Empirical (Pi-group) scaling laws for craters created on an inclined granular layer by an oblique impact of a spherical projectile were experimentally obtained. In the experiment, inclination angle and incident angle were systematically (and independently) varied in the ranges of 0 to 33 degree and 10 to 170 degree, respectively. A spherical projectile (diameter 6 mm) was impacted onto a surface of inclined granular layer with an impact speed 10 - 100 m/s. Two high-speed cameras and laser profilometry system were used to measure the impact speed, angle, and final crater shape. From the experimental results, we found following behaviors. When the incident angle is small, almost symmetric craters were observed. However, the collapse of the upper crater wall was triggered when the inclination angle is large enough. The scale of the collapse grows as the inclination angle is increased. In addition, the crater volume strongly depends on inclination angle. By combining these experimental findings, we developed the empirical scaling for crater dimensions and aspect ratios. The obtained scaling is consistent with previous works on the normal impact to horizontal granular surface with high impact speed. We also discuss a possible way to evaluate the impact conditions from the actual astronomical impact craters.

Keywords: oblique impact, inclined granular layer