Ejection behavior after hypervelocity oblique impacts in an atmosphere

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It is believed that the Australasian strewn field is an outcome after an hypervelocity oblique impact. The impact must occur in a thick Earth’ s atmosphere, resulting in an intense interaction between ejected materials and the surrounding atmosphere. Here, we report about a new experimental apparatus to investigate the impact outcomes after hypervelocity impacts under an atmosphere. The system has been installed to a hypervelocity impact laboratory at Planetary Exploration Research Center of Chiba Institute of Technology. The system is consist of a two-stage light gas gun, a vacuum chamber with a gas inlet and with two glass view ports that face each other, a high-speed video camera, and a pulsed-diode laser-light source. In addition, we constructed a Schlieren imaging optics between the light source and the camera to visualize the flow field driven by an downrange moving ejecta plume. We could capture Schlieren images with the time resolution of 0.2 microsecond. By using the system, we conducted a series of hypervelocity oblique-impact experiments with polycarbonate projectiles 4.8 mm in diameter. The impact velocity was ranged from 2.7 km/s to 6.9 km/s. The impact angle was fixed at 45 degrees measured from the target surface. Three different targets, which are made of polycarbonate, aluminum, and copper, were used to examine the effects of the shock impedance of the target materials on the ejection behavior. After the air in the chamber was evacuated, we introduced N_2 or Ar gas into the chamber up to 6.0 kPa. We observed a downrange moving ejecta plume and an intense atmospheric interaction with the surrounding gas as a strong self-emission in the visible range. We found that the morphology of the ejecta plume depends on both impact velocity and the target materials. In the poster presentation, we will discuss about possible environmental perturbations after the hypervelocity oblique impact.

Keywords: The Australasian strewn field, Hypervelocity oblique impacts, atmospheric interaction

