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Laboratory Experiments of Impact onto Chondrites and Ejecta Recovery

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Hypervelocity impacts from interplanetary space excavate craters, disrupt boulders, disturb regolith, and modify the material composition on asteroid surfaces. The fragments generated by the impacts are major sources of interplanetary solid bodies including dust particles. The ejecta eventually become the potential impactors onto small bodies. Lots of impact experiments onto rocks and analog targets of asteroids have been performed in the laboratory, however, only limited impact experiments using meteorites have been conducted. In an impact disruption experiment consisting of an aluminum projectile fired at a velocity of 4.45 km/s to a target of Murchison CM2 chondrite meteorite, it was shown that Murchison disruption significantly over-produced fragments of hundreds micron in size compared to anhydrous meteorite targets (Flynn et al. 2009).

Accelerating a projectile by laser ablation is suitable for conducting impact experiments onto meteorites which are limited in amount; because it can aim small projectile at the target with better accuracy than a gas-gun in general and thus requires less amount of target material. Therefore, we performed a series of hypervelocity impact experiments, in that, the target materials were an LL5 chondrite, Allende and Murchison meteorites. Aluminum spheres of 80-242 micron in diameter were accelerated by laser ablation using a GEKKO XII-HIPER laser at the Institute of Laser Engineering of Osaka University (Kadono et al. 2010). The impact velocity ranged from 10.7 to 43.9 km/s. We collected the ejecta by aerogel blocks deployed near the targets. Deep craters were formed on Murchison meteorite targets while very shallow and irregular-shaped depletions were formed on LL5 chondrite targets regardless of the impact velocity. We will also present the preliminary results of the ejecta size distribution.

Keywords: impact, asteroid, ejecta, dust, crater