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Fragmentation Degree of Impactor in Collision between Asteroids

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Introduction

Many of meteorites are fragments of disrupted asteroids, and we can get the information of early stages of the Solar System, because it is considered that thermal activity was stopped in the early stage in the parent bodies of chondrites. Meteorites are classified according to their parent bodies and chemical composition. However, there are meteorites in which the components from various parent body origins are mixed. About 20 % of ordinary chondrites have brecciated. Brecciated meteorites were probably formed by impacts of smaller bodies into boulders or regolith of another bodies and being captured in the regolith (e.g. Rubin et al. 1983).

In this study, we assumed that a meteorite impacts into regolith, and the fragments are captured in regolith. We aimed to clarify fragmentation degree of projectile.

Experiments

Projectiles simulating meteorites are impacted on regolith like sand targets at velocities of 167 to 429m/s. The samples used as projectiles were pyrophyllite cylinders and as targets were silica sand. The impact experiments were performed mainly by a single-stage powder gun facility at the department of Science, Kobe University. Recovered fragments were sorted out by 0.5mm size meshes.

Results

We studied that the relation of the largest fragment mass to impact energy density (in this study, it was defined as the kinetic energy of the projectile per unit mass of the projectile) and the peak pressure. It was found that projectiles began to break at 10^4 J/kg in kinetic energy density, and this is large by two orders of magnitude when compared with the value of the previous experiment (Takagi et al. 1984) with larger targets. Projectiles began to break at initial pressure of 300 MPa, and this is larger than the compressive strength of pyrophyllite.

We will conduct experiments on the influence of the difference in rock material as projectiles and the particle diameter of sand as targets, and discuss on the results.

Keywords: asteroid, meteorite, impact