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Collisional disruption experiments of pyrophyllite small targets for study on ejecta distribution

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Although impact fragmentation of small bodies is one of the main sources of interplanetary dust particles within the solar system, it has not fully understood so far how many dust-sized fragments are produced by a given collisional disruption. In the previous experiments, size distributions of fine ejecta from impact were often estimated from penetration holes formed by the ejecta on Al-foils as secondary targets. However, only a fraction of ejecta could be detected by limited coverage of the solid angle. In this study, we conduct impact experiments and attempt to capture all of the ejecta in order to examine the size distribution of debris produced by the collision.
The impact experiments were performed using a small single-stage light-gas gun at Kobe University. Glass spheres of 3.2 mm in diameter were shot into pyrophyllite targets of 2.8 to 7.3 mm on a side. The impact velocity ranged from 242 to 275 m/s. Targets were suspended in an acrylic box by thread. The inner walls of the box were covered by stacks of ultralow bulk-density foamed polystyrene papers ($1.3*10^{-2}$g/cm^3) to capture the ejecta intact.
The size distribution curve of ejecta which were not captured by the foamed polystyrene papers has an inflection point at around 50 to 60 micrometer. The inflections of the size distributions were reported in the previous experiments with hydrated targets (Flynn et al., 2005) and a carbonaceous chondrite meteorite target (Flynn et al., 2009). The inflection point varies possibly according to the experiment conditions such as target size. Another possibility is the flaw distribution in the target material. The distribution of flaw trace length of granite has an inflection point around 50 to 60 micrometer (Housen and Holsapple, 1999). We will discuss on the inflection point of the size distribution of ejecta.
Takagi et al. (1984) conducted impact experiments with pyrophyllite targets of a few several cm on a size. They showed that the slopes of the size distribution of the larger ejecta changed according to the experiment condition, but the slopes of the smaller ejecta were approximately the same despite difference of experiment conditions. Although the targets used in this experiments were about one-tenth of those used in the experiments of Takagi et al. (1984), the slope of the size distribution of the smaller ejecta also about the same as Takagi et al. (1984).

Keywords: Imact experiment, size distribution, ejecta, pyrophyllite, small body