Statistical analysis of grain morphology generated under hypervelocity impact experiment as an analog of volcanic explosion

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Natural volcanic ash is formed in several states of magma (i.e., solid or melt) and surrounding conditions (e.g., dry or wet settings). These various factors affect the morphology of ash grain. For example, in a wet setting, moss-like grains are often formed (e.g., Wohletz, 1983). Thus, grain shape of volcanic ash tells us its fragmentation process. This would be useful to estimate eruption mechanism both for on-going and historical eruptions. However, it is difficult to extract the fragmentation mechanism from the grain morphology because of the complex natural system (i.e., not by a single mechanism). Furthermore, manual verification of numbers of ash grains takes a long time and need training. To simplified these issues, we proposed a technique to measure the morphology of volcanic ash grains by using an automatic grain analyzing system (Noguchi et al., in prep.). In this study, we apply the technique to the grains formed by an impact in a laboratory in order to verify the accuracy and applicability of the technique. We used a two-stage light-gas gun in ISAS, JAXA. Grains were collected using a Styrofoam box and segregated with d-limonene. After that, we measured shape parameters and transparency using an automated grain analyzer (Morphologi G3S, Malvern Inst.) of AIST. The measured parameters of grain shape are aspect ratio, high-sensitivity circularity, convexity, and solidity. We also measured transparency of each grain. In this presentation, we show its preliminary result and indicate its applicability to returned sample from other planetary bodies such as Itokawa, Ryugu, and Phobos.

Keywords: Volcanic ash, Impact experiment, grain morphology

