Static and impact strength of brittle regolith analogs

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Thermal observations showed that the surface rocks of the asteroid Ryugu have large porosity. Comparison of the porosity and strength of the returned samples with those of meteorites and terrestrial rocks is of interest in understanding the evolution of asteroid materials. Generally, a structure having a large porosity has a lower static strength than a structure having a dense structure even if the structure has the same composition. However, the relationship between static strength and porosity is not one-to-one. In addition, the relationship between impact strength and static strength also varies depending on the structure and material composition.

We have investigated static strength and impact strength of some natural brittle materials [1-4]. Samples were basalt, chondrules disassembled from meteorite specimens, dunite, pyrophyllite, pumice, and sandstones. Crushing strength was determined from compression test of spherical specimens and tensile strength was determined from compression test of disc specimens (Brazilian disc test). We obtained the Weibull parameter from the static strength measurement results of the samples, and the value range was 1.5 to 24. Two types of impact disruption experiments were conducted. One is the usual one using brittle targets and study the disruption threshold of the targets, and the other is the case of a small specimen using a brittle sample as a projectile. These results are discussed in comparison with the literature data of chondrites [5, 6].

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