Preliminary measurements on bulk mechanical and electrical properties of meteorite powders

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In-situ measurements of asteroids have provided variable information regarding the mechanical conditions of the surfaces of asteroids, including high-resolution images, global slope-distributions, small-scale topographies, thermal conditions, and reflection rates of electro-magnetic waves. Most of these observations will be performed by future missions including Hayabusa-2 and OSIRIS-Rex missions. Mechanical and electrical properties of regolith should be a complicated function of size-distributions of regolith materials and their chemical compositions and shapes, which would be results of the history of processes working on these particles.
For this reason, we are interested in the bulk properties of gravel such as shearing resistance, which is the most essential information on the movement and the stability of loose gravel [1]. Specifically, the shear resistance force in a dry condition is ultimately controlled by the friction angles of particles. The friction angles of meteorites are, however, generally difficult to measure because of limited amount of mass utilize for the measurements. In course of this work, we are currently developing a new method to measure friction angles of gravel with various size-frequency distributions using terrestrial standard sand specimens. We measured the friction angles of Toyoura standard sand by a modified injection method, which requires only about 1.7 x 10^3 mm^3 for obtaining consistent values estimated by a standard injection method [2]. The required amount of samples is about 1/3,500, which becomes significantly important when we perform similar measurements on meteorites. We also measure dielectric properties of the gravel to properly evaluate the reflectance to discuss the bulk porosity of regolith materials within the skin depth.

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