[EE] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS02]Regolith Science

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Recent planetary explorations have revealed that almost all solid bodies in the solar system are covered with small particles, called regolith. The surface geology, especially regolith behavior on the surfaces of solid bodies, becomes increasingly more important as represented by Hayabusa mission and other on-going and planned sample-return missions such as Hayabusa2 going to an asteroid Ryugu, OSIRIS-REx going to an asteroid Bennu and MMX planning to go to the martian satellites.

For fully understanding the regolith science, it is required to know and compare the regolith conditions on various celestial bodies, from asteroids to planets, with various methods.

Therefore, this session welcomes broad topics related to regolith on various celestial bodies, such as asteroids, comets, the Moon, the martian moons, Mars, etc. Papers on the formation, evolution, and alteration processes of regolith particles and regolith systems on the surface of planetary bodies, remote and in-situ observational results and techniques, analyses and results of returned samples, and laboratory, numerical, and theoretical studies on the fundamental physical and chemical processes are all welcome.

[PPS02-P07]Thermal conductivity of lunar regolith simulant and implication to grain size estimate using thermal inertia

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Many air-less planetary bodies are covered by regolith. The thermal conductivity of the regolith is an essential parameter controlling the surface temperature variation and depends on physical condition such as grain size and density. In order to estimate physical condition of the planetary surface materials using infrared remote sensing data, a thermal conductivity model applicable to natural soils as well as planetary surface regolith is required. In this study, we investigated the temperature and compressional stress dependence of the thermal conductivity of the lunar regolith simulant JSC-1A under vacuum conditions. Moreover, we prepared some sieved JSC-1A samples and their thermal conductivities were also measured. The comparison with the thermal conductivity of original JSC-1A has an important role for evaluating the effect of the grain size distribution, and comparison with the thermal conductivity of spherical beads aids in determining the effect of the grain shape on the thermal conductivity.

As a result, we found that JSC-1A has similar solid and radiative conductivities to Apollo regolith samples, and it can be used to simulate the thermal conductivity of the lunar top surface. We also confirmed that a series of the experimental data for JSC-1A can be calibrated by an analytical thermal conductivity model we developed (Sakatani et al., 2017, AIP Adv.). Moreover, the thermal conductivity of sieved samples with grain size about 100 μm had a similar conductivity to the original JSC-1A. The original sample has a volumetric median grain size about 100 μm, so that it is inferred that the thermal property of soils with a broad grain size distribution can be modeled as mono-sized grains with a volumetric median. In other words, a grain size estimated from the thermal observation data is a

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volumetric median size. Comparison with the experimental data for size-sorted spherical glass beads indicated that the irregular shapes of the natural samples reduce the conductivities by a few ten percent. We are planning to apply the thermal conductivity model calibrated in this study to the Hayabusa2 Thermal Infrared Imager data of asteroid Ryugu so as to determine the spatial distribution of the grain size of surface materials on the asteroid.

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