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Non-contact Measurements for Thermal Inertia of Granular Materials

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Thermal inertia is defined as a combination of thermal conductivity, density, and heat capacity. It represents the ability of the subsurface to conduct and store heat energy away from the surface during the day and to return that heat energy to the surface through the night [Mellon et al., 2000]. Thermal inertia is an important parameter which controls surface temperature of planetary surface.

It is important to measure the thermail inertia of granular materials because planetary soils are composed of small grains. Many existing researchs focus only on thermal conductivity of granular materials, and use ”line-heat method” which affects the pacikng state of granular materials to measure the thermal conductivity.

We applied a non-contact measuremet for thermal inertia [Buettner, 1951] to the layers of granular materials. The mothod is a simple way to measure thermal inertia and don’t disturb the packing state of granular materials.

We measured the thermal inertia of artificial granular materials (e.g. almina ball) and natural soil samples (e.g. small grains of pyroclastic fall deposit) and compared our results with the results of previous studies [e.g. Presley and Christensen, 1997; Iwasaki, 2009 (Master Thesis, The Univ. of Tokyo)].

Keywords: thermal inertia, granular material, planetary surface