Abstract:

Thermal processing is an effective way to extract solar wind implanted particles (SWIP) from lunar regolith. For heating a larger amount the behavior of its thermal properties, especially conductivity, at higher temperatures is essential. The goal was the experimental determination of thermal conductivity of the regolith simulant JSC-1A under vacuum conditions (10^{-5} mbar) at temperatures of up to 650°C. Literature provides some data of measured thermal conductivities of lunar regolith which vary from 9 \times 10^{-3} to 25 \times 10^{-3} W/(m K) for temperatures between -20°C and 20°C under vacuum conditions. This variation and uncertainty of data required new measurements and more research on this topic. Therefore, a cavity receiver breadboard was used which was originally designed to optimize homogenous heating of JSC-1A. A steady state measurement method was applied to this experiment, where mean temperatures of the JSC-1A sample of up to 650°C were reached. The results show a cubic increase of the thermal conductivity as a function of temperature from 8 \times 10^{-3} W/(m K) at 150°C to 33 \times 10^{-3} W/(m K) at 650°C. This increase seems to be caused by heat transfer due to radiation, the dominating heat.
conduction mechanism in powders under vacuum conditions. In general, the comparison of the results with past studies of different authors shows the same order of magnitude. After having a first impression, more substantial work will be necessary to improve knowledge about thermal conductivity of real lunar regolith and its simulants.

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