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HEAT CONDUCTIVITY AND CAPACITY EXPERIMENTS IN LUNAR REGOLITH SIMULANT

Abstract

Since late 2011 the German Aerospace Center (DLR) has been investigating means to generate electrical power using residual heat stored in the lunar regolith. One path of investigation has been the set-up and execution of several experiments involving lunar regolith simulant (JSC-1A). To measure the heat transfer efficiency of a heat exchanger using liquid nitrogen, a first experiment was set up. This test involved a vacuum chamber, where a simple test heat exchanger was subdued in regolith simulant and has been traversed by liquid nitrogen. Via temperature and mass flow measurements the heat transfer coefficient, depending on flow condition as well as state variables like temperature, was determined. During the experiment campaign it has become obvious that there is no systematic collection of heat capacity data for JSC-1A simulant. To fill this gap it was decided to modify the test stand for experiments determining the heat capacity of JSC-1A via measuring the thermal conductivity and the thermal diffusivity. The tests gain the temperature-dependent thermal properties in a temperature range of -180C to +80C under vacuum conditions. In this paper the authors present the experiments' layout, the results of measurement and discuss their implications. We will further point out how this data can be used for further projects in DLR and in the space community in general, e.g. for design of lunar habitats and other infrastructure.