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Study of Electro-Cyclonic Filtration and Pneumatic Transfer of Lunar Regolith Simulants under 1/6-g and 1-g Gravity Conditions

James G. Mantovani¹, Ivan I. Townsend², Robert P. Mueller¹

¹NASA Kennedy Space Center, ²ASRC Aerospace

NASA has built a prototype oxygen production plant to process the lunar regolith using the hydrogen reduction chemical process. This plant is known as “ROxygen – making oxygen from moon rocks”. The ROxygen regolith transfer team has identified the flow and transfer characteristics of lunar regolith simulant to be a concern for lunar oxygen production efforts. It is important to ISRU lunar exploration efforts to develop hardware designs that can demonstrate the ability to flow and transfer a given mass of regolith simulant to a desired vertical height under lunar gravity conditions in order to introduce it into a reactor. We will present results obtained under both 1/6-g and 1-g gravity conditions for a system that can pneumatically convey 16.5 kg of lunar regolith simulant (NU-LHT-2M, Mauna Kea Tephra, and JSC-1A) from a flat-bottom supply hopper to a simulated ISRU reactor (dual-chambered receiving hopper) where the granular material is separated from the convey gas (air) using a series of cyclone separators, one of which is an electrically enhanced cyclone separator (electrocyclone). The results of our study include (1) the mass flow rate as a function of input air pressure for lunar regolith simulants that are conveyed pneumatically as a dusty gas in a vertical direction against gravity under lunar gravity conditions (for NU-LHT-2M and Mauna Kea Tephra), and under earth gravity conditions (for NU-LHT-2M, Mauna Kea Tephra and JSC-1A), and (2) the efficiency of the cyclone/electrocyclone filtration system in separating the convey gas (air) from the granular particulates as a function of particle size.