TRIBOCHARGING LUNAR SIMULANT FOR ELECTROSTATIC BENEFICIATION. J.W. Quinn[1], J.G. Captain[2], K.H. Weis[2] and S. Trigwell[2]. [1] NASA Kennedy Space Center Surface Systems Office NE-S-2 Kennedy Space Center, FL 32899. Jacqueline.W.Quinn@nasa.gov), [2]ASRC Aerospace, Mail Stop: ASRC-20, Kennedy Space Center, FL 32899

Introduction: Any future lunar base and habitat must be constructed from strong dense materials in order to provide for thermal and radiation protection. Lunar regolith has high concentrations of aluminum, silicon, calcium, iron, sodium, and titanium oxides. Refinement or enrichment of specific minerals in the soil into an industrial feedstock before it is chemically processed may be more desirable as it would reduce the size and energy requirements required to produce the virgin material and it may significantly reduce the process' complexity. In addition, shipping oxygen from the earth is weight prohibitive, and therefore investigations into the potential production of breathable oxygen from oxidized mineral components are a major research initiative by NASA. The feasibility of extracting oxygen from the FeO component by hydrogen reduction in terrestrial soils has been demonstrated, and a number of oxygen production technologies are being tested by NASA's In Situ Resource Utilization program. Ilmenite in particular is a mineral of interest on the moon as a source of iron, titanium, and oxygen ($FeTiO_3$), and therefore any method to increase its natural abundance in excavated ore before processing would be a considerable advantage.

Electrostatic beneficiation of lunar regolith is currently being investigated as part of the In-Situ Resource Utilization (ISRU) program at Kennedy Space Center (KSC). The lunar regolith grains and the lunar environment are ideal for triboelectrification and electrostatic separation, with the lack of moisture preventing the grains from sticking together, lack of atmospheric gaseous breakdown allowing higher voltages to be used on the separation plates, and the gravity only being 1/6 that of earth that will allow the particles longer charge contact times and time between the plates to enhance the separation.

This presentation describes the use of tribocharging lunar simulant prior to mineral grain separation. The lunar simulant NU-LHT-2M was either used as the full size-range or was sieved to the 75-100 µm particle range before being passed through a twisted aluminum charger and separated in an electric field. The amount of charge acquired by the simulant is dependent upon the difference in the work function of the charging material and the mineral grain composition of the simulant itself. Scanning Electron Microscopy was used to evaluate the NU-LHT-2M simulant before and after beneficiation. Results indicate notable changes in mineral composition between pre- and post-beneficiation samples using SEM techniques for the 75-100 µm particle range; which was corroborated by hydrogen reduction analyses performed at the Johnson Space Center on the same sample set. SEM analysis was not statistically defensible at the 95 percent confidence level for the full particle size-range, however hydrogen reduction of the full size-range yielded significantly higher water values (indicating enhanced mineral enrichment for oxygen-baring minerals) using the beneficiation technique as compared to the control.

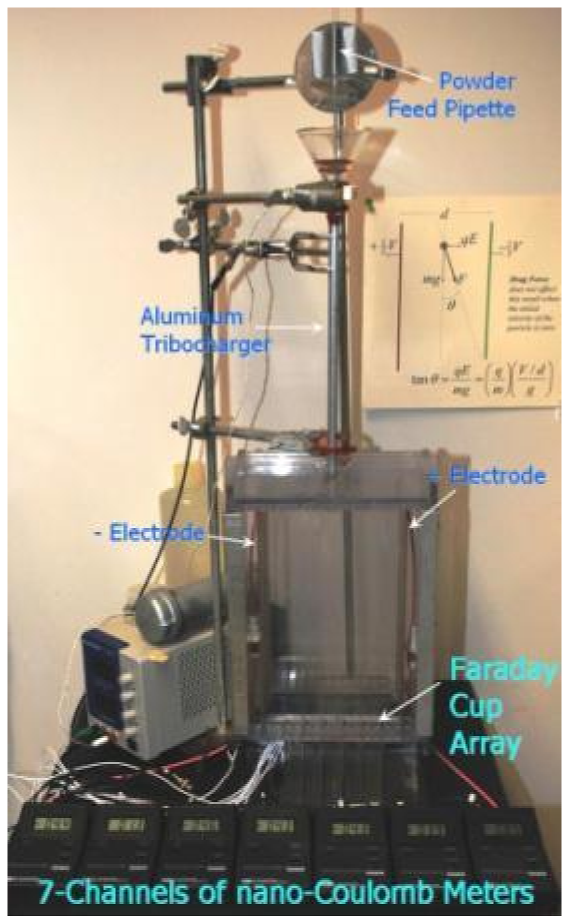

Photo of tribocharging chamber in the lab at KSC