

Beneficiation of Lunar Regolith Simulants through Electrostatic and Magnetic Separation: Concept of Operations. P. Bachle¹, C. Wood, J. Smith¹, F. Rezaei¹, D. Bayless¹, W. Schonberg¹, and D. Han¹, ¹Missouri University of Science and Technology, 400 W. 13th Street, Rolla, Missouri 65409. (Contact: handao@mst.edu)

Introduction: Separating lunar regolith particles by chemical composition is important to optimizing subsequent metal extraction. Sorting by iron content is a method of separation that is likely attainable in a lunar environment due to the lack of reliance on gravity as the primary motivating force. Lunar regolith is comprised mostly of plagioclase (diamagnetic), olivine and pyroxene (paramagnetic), and iron micrometeorites (ferromagnetic) mixed with agglutinates [1]. Therefore, designing a lightweight, low power magnetic separator is one of the goals of our ongoing LuSTR21 Project. At LSIC Spring 2024, we will report the progress of the designs of the concept of operations: stationary and mobile for regolith beneficiation [2].

Design: Figure 1 shows a prototype for the concept of “stationary operation” for the combined magnetic/electrostatic separation.

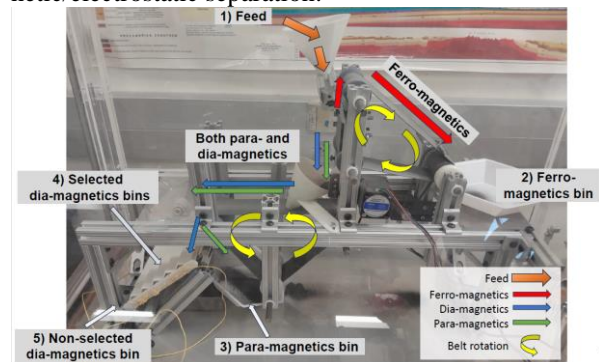


Figure 1. A concept of operation for stationary operation.

Results: Figure 2 shows the mass breakdown of simulants for the operation of the “stationary” prototype.

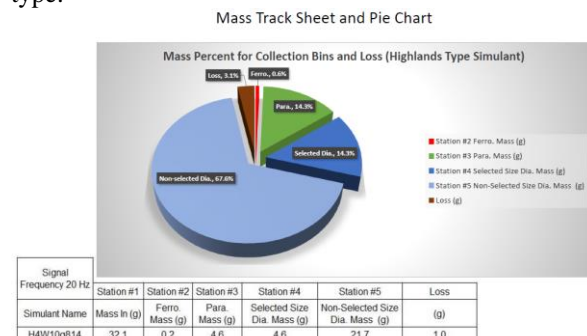


Figure 2. Mass track sheet and pie chart for the collected simulants at different stations as labeled in Figure 1.

Figure 3 shows the initial analysis of particle size separation for the stationary operation.

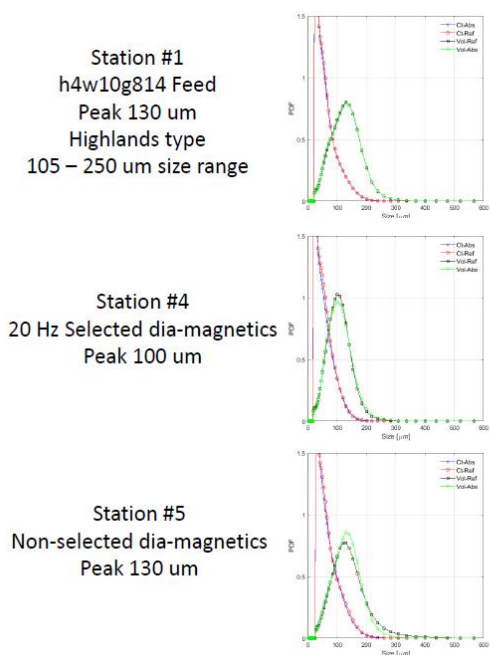


Figure 3. Particle size distribution for the stationary prototype.

For the concept of operation for “mobile” operations, a nominal rover has been built with prototype separations. We expect to get a prototype hardware ready in Early March and will plan to do technology demonstrations at the LSIC site.

References:

- [1] Papike, J., Simon, S., & Laul, J. (1982) The lunar regolith: Chemistry, mineralogy, and petrology. *Rev of Geophys*, 20(4), 761–826.
- [2] Bachle, P., Smith, J., Rezaei, F., Bayless, D., Schonberg, W., and Han, D. (2024) Beneficiation of Lunar Regolith Simulants through Electrostatic Sieving and Magnetic Separation. *AIAA SciTech 2024*, AIAA 2024-2539.