High Fidelity Lunar Agglutinate Simulant

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Regolith simulants are essential tools for testing both scientific processes and spaceflight hardware in the absence of the Lunar environment. The Lunar Highlands Regolith Simulant (LHS-1) produced at the CLASS Exolith Lab aims to replicate the mineralogy and particle size distribution of the Lunar highlands regolith, giving it a high fidelity and enabling the space industry to utilize it for testing. The primary feature lacking within many Lunar soil simulants is the agglutinate component. Agglutinates are glassy matrices of melted regolith caused by micrometeorite bombardment on the Lunar surface, typically making up anywhere from 5% to 60% of the regolith's composition[1].

A methodology has been developed at the Exolith Lab to form simulated agglutinates through a high energy input. These simulated agglutinates consist of 99% anorthosite and 1% fine (<100 micron) metallic iron by weight, giving the agglutinates ferromagnetic properties. The ability to change the simulant's agglutinate content allows us to vary the maturity and glass content with higher fidelity. We are currently characterizing the rheological properties of LHS-1 mixed with 25% simulated agglutinates, representing an intermediate regolith maturity. We will present preliminary data on the mass flow rate as a function of funnel opening size for a series of funnels. These preliminary results will provide important implications for the simulant's use in ISRU processes such as beneficiation and molten regolith electrolysis.

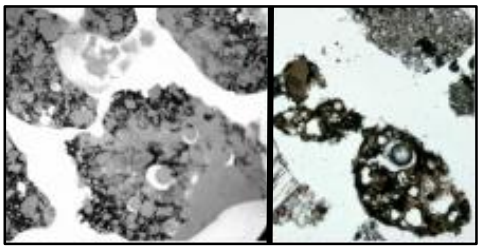

Figure 1. *Microscopic image in transmitted, plane polarized light of a thin section of a simulated agglutinate (highlands composition, left) and an actual Lunar highlands agglutinate (right). Field width for left image is 1.5mm and field width for the right image is 1.6mm.*

Figure 2. *Agglutinated LHS-1 Simulant and large agglutinate*

[1] Taylor, L. A., C. Pieters, A. Patchen, D.-H. S. Taylor, R. V. Morris, L. P. Keller, and D. S. McKay (2010), Mineralogical and chemical characterization of lunar highland soils: Insights into the space weathering of soils on airless bodies,J. Geophys. Res.,115, E02002, doi:10.1029/2009JE003427.