

Simulant Name: LHS-1 Highlands Simulant
Simulant Type: General purpose
Reference Material: Average lunar highlands
Uncompressed Bulk Density: 1.30 g/cm³
Mean Particle Size: 90 μm
Median Particle Size: 60 μm
Particle Size Range: <0.04 μm – 1000 μm



Geotechnical Properties

¹**Grain Density:** 3.22 g/cm³
¹**Void Ratio:** 1.477
¹**Porosity:** 59.6%
²**Avg Angle of Repose:** 39.58°
²**Max Angle of Repose:** 47.5°
³**Cohesion:** 0.311 kPa
³**Angle of Internal Friction:** 31.49°

Geotechnical Property Sources

¹[5013.PDF \(usra.edu\)](#)

²[\(PDF\) Comparing the Effects of Mineralogy and Particle Size Distribution on the Angle of Repose for Lunar Regolith Simulants \(researchgate.net\)](#)

³[2038.PDF \(usra.edu\)](#)

Mineralogy

As mixed.

Component	Wt.%
Anorthosite	74.4
Glass-rich basalt	24.7
Ilmenite	0.4
Pyroxene	0.3
Olivine	0.2

Bulk Chemistry

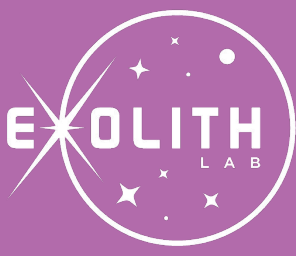
Relative abundances. Measured by XRF.

Oxide	Wt.%
SiO ₂	51.2
TiO ₂	0.6
Al ₂ O ₃	26.6
FeO	2.7
MnO	0.1
MgO	1.6
CaO	12.8
Na ₂ O	2.9
K ₂ O	0.5
P ₂ O ₅	0.1
LOI*	0.4
Total**	99.4

Safety

See SDS for details. Primary hazard is dust inhalation; wear a respirator in dusty conditions.

* Loss on ignition
** Excluding volatiles and trace elements



Trace Elements

Measured by XRF

Element	ppm
Ni	26
Cr	54
V	46
Sc	6.2
Cu	14
Zn	29
Ga	19
Ba	265
Rb	9
Cs	0
Sr	349
Y	4
Zr	59
Hf	1.9
Nb	10.6
Ta	1
Mo	4
La	12
Ce	20
Nd	7
Sm	0.7
Dy	1.9
Yb	0.0
Th	0
U	1
Tl	0
Pb	4
Sn	3
Bi	0
Sb	1

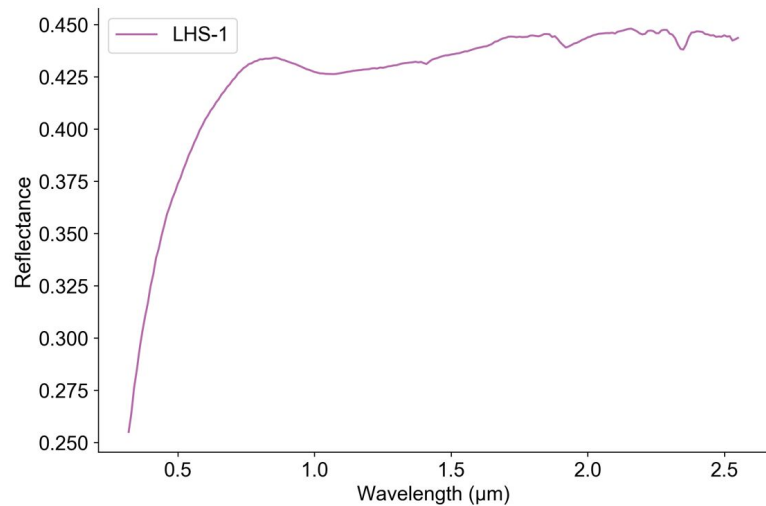
Volatiles

Measured by XRF

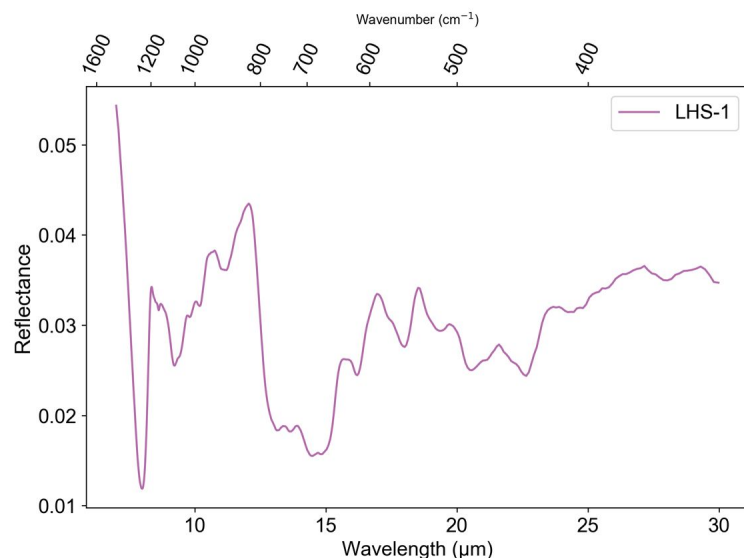
Compound	Wt%	Compound	ppm
F	≥0.07	Br	≥3
Cl	≥0.006	As	≥1
SO ₃	≥0.01		

Reflectance Spectrum

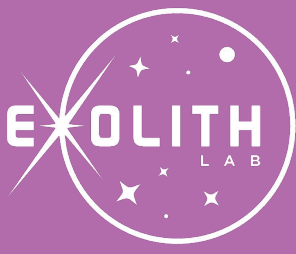
Incidence angle 30°, emission angle 0°



Mid-Infrared FTIR Spectrum

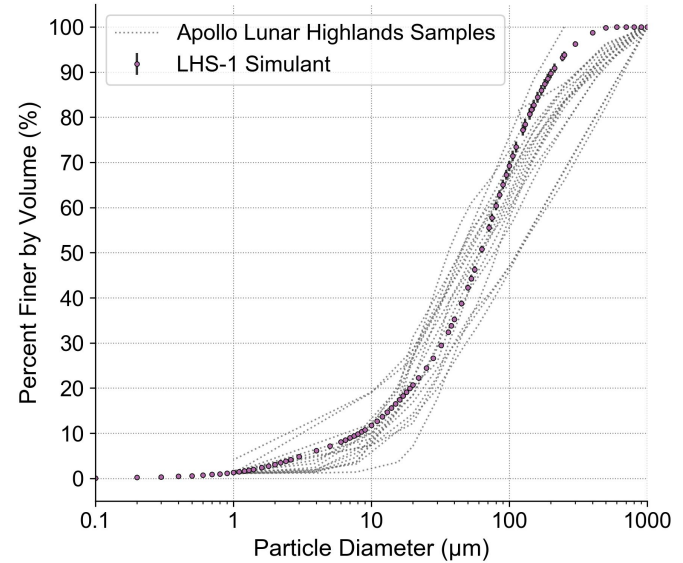
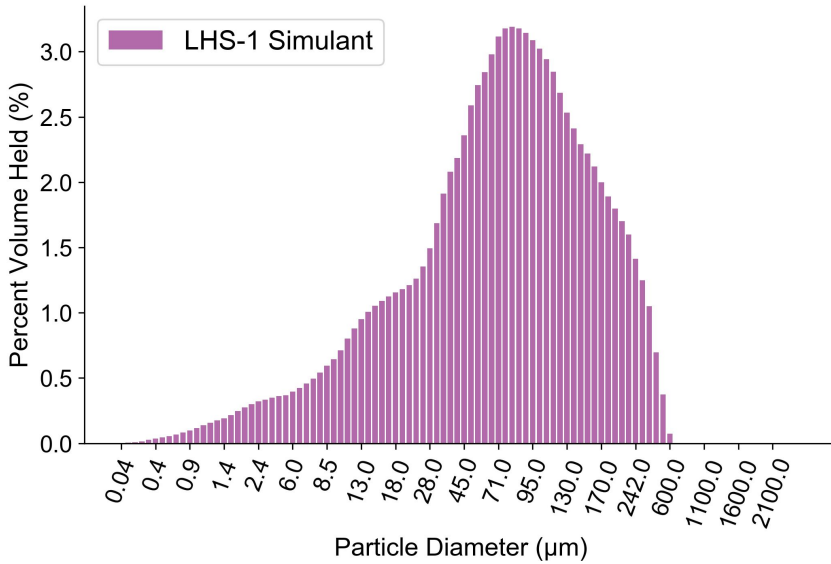


XRF data obtained by Hamilton Analytical Lab using fused bead sample preparation. FTIR spectrum courtesy of Dr. Takahiro Hiroi, NASA RELAB, Brown University.



Volumetric Particle Size Distribution

From CILAS 1190 laser diffraction particle size analyzer



Sieve Analysis

Following ASTM Standard E11 using RO-TAP RX-30 sieve shaker

Sieve Number	Diameter (µm)	Mass of Soil Retained on Each Sieve (g)	Percent Retained by Mass (%)	Cumulative Retained by Mass (%)	Percent Finer by Mass (%)
18	1000	0.0	0.0%	0.0%	100.0%
25	710	35.3	3.6%	3.6%	96.4%
35	500	35.3	3.6%	7.1%	92.9%
45	355	36.7	3.7%	10.8%	89.2%
70	212	73.3	7.4%	18.2%	81.8%
140	106	288.7	29.1%	47.3%	52.7%
200	75	176.0	17.7%	65.0%	35.0%
270	53	210.0	21.2%	86.2%	13.8%
Pan		137.3	13.8%	100.0%	0.0%

Sieve analysis skews particle size larger, as many of the fines cling to the larger pieces of regolith. This is measured by mass percent rather than volume

