HISPANSION

Technical Data Sheet: TLM-0

TDS-TLM-0-v2.0

1. Overview:

Figure 1: TLM-0 Close-up View

- **Type:** Low-Ti Mare
- **Series:** TerraLun™- Core
- **Composition:**
  - Basalt
  - Anorthosite
  - Altered Peridotite
- **Mean NASA FoM Score:** 90.9 %
- **100 % European** Sourced & Manufactured.
- **Uses:** High-fidelity general simulant suitable for geotechnical and mobility testing, excavation and construction trials, large-scale testbeds, ISRU process development, dust and environmental studies, filtration and sealing validation, scientific research, and technology demonstration.

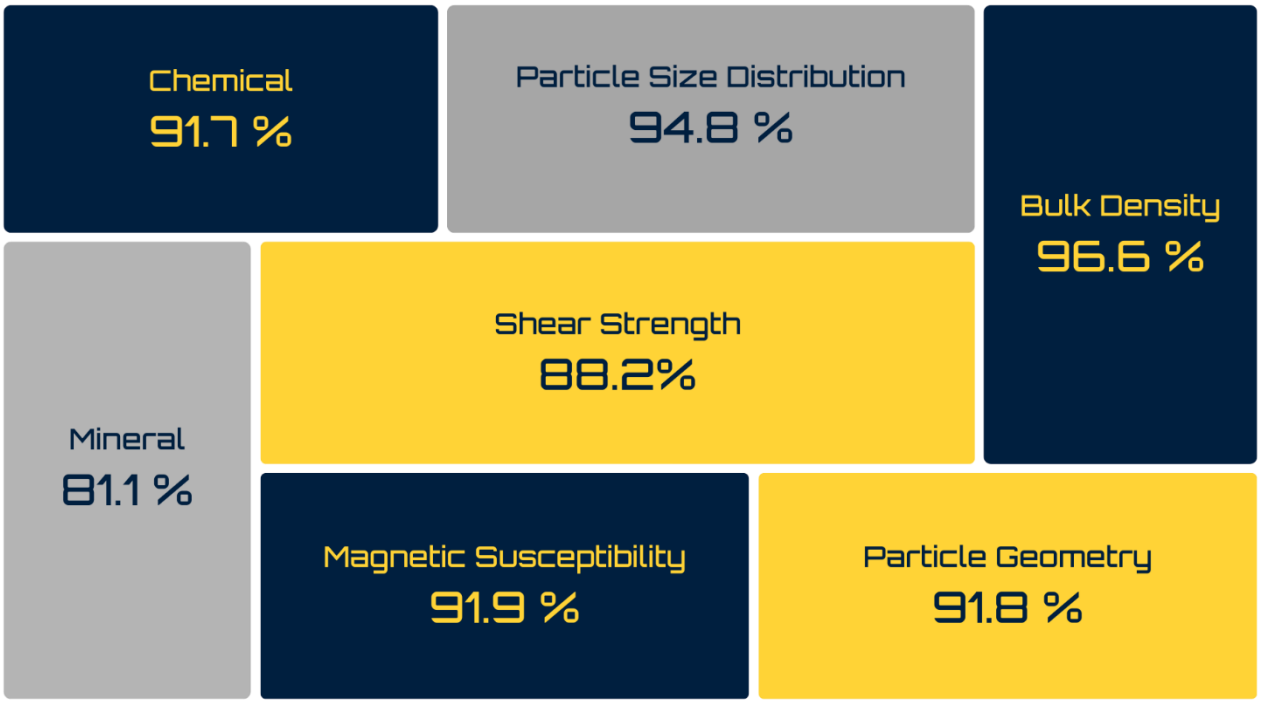


Figure 2: NASA Figures of Merit Results for TLM-0

2. Product Characterization

2.1 Chemical Composition

Chemical composition obtained through X-ray fluorescence analysis (XRF) performed by UPV/EHU with a Bruker M4 TORNADO.

SiO_2	TiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	K_2O	SrO	Cr_2O_3	NiO	ZnO	MnO
47.33	1.72	14.38	12.44	12.38	8.38	0.00*	1.28	0.25	0.14	0.11	0.01	0.19

Table 1: Chemical Composition of TLM-0

*Na2O is expected to be present according to the mineral composition, but it might be below the identification and quantification limit of this machine.

2.2 Mineral Composition

Mineral composition and quantification of glass/amorphous fraction through X-Ray Diffraction analysis (XRD) performed at UCLM by Jacinto Alonso-Azcarate with a PANalytical Xpert PRO machine. Supplemented by a Raman Spectroscopy performed at UPV/EHU with a Raman Renishaw InVia micro spectrometer.

Anorthite	Augite	Enstatite	Fosterite	Lizardite	Analcime	Smectite	Illite	Quartz	Hornblende	Amorphous/ Glass
35.2	17.2	1.9	2.1	5.7	3.8	1.2	0.6	0.6	0.3	31.4

Table 2: Mineral Composition of TLM-0

Pyroxene	Plagioclase Feldspar	Olivine	Ilmenite	Glass
19.1	35.2	2.1	0	31.4

Table 3: Mineral Group Classification of TLM-0

2.3 Bulk Density

Bulk minimum, maximum, mean density as well as particle density were measured by TÜV SÜD's Geotechnics Department. The tests were performed following norms; UNE-EN ISO 17892-3:2018 (Particle Density), UNE 103015:1993 (Minimum Density) and UNE 103106:1993 (Maximum). The norms applied for maximum and minimum density are not specifically designed for materials with high fine fractions and in the case of the maximum density it can result in values higher than reality.

Minimum Density: 1.33 g/cm^3

Maximum Density: 2.01 g/cm^3

Mean Density: 1.67 g/cm^3

Particle Density: 2.79 g/cm^3

2.4 Particle Size Distribution

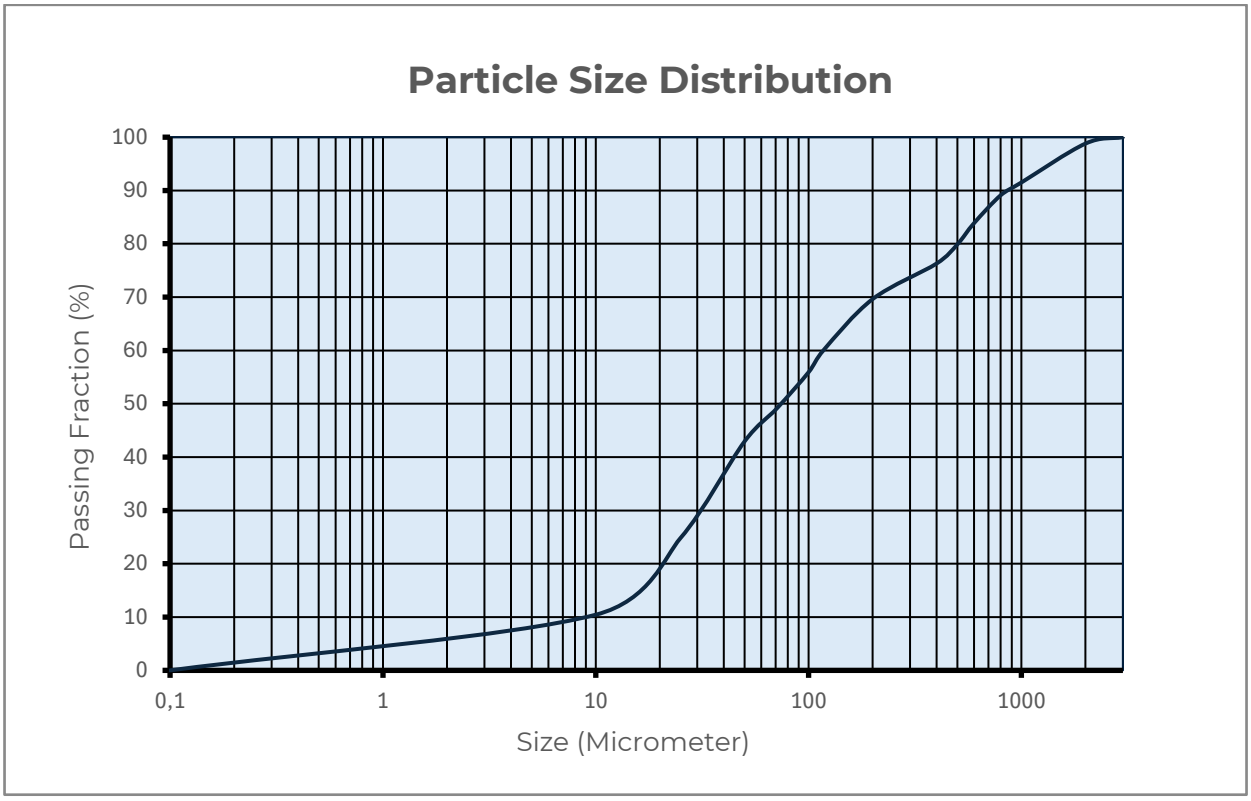
Particle size distribution (PSD) measured through Dynamic Image Analysis performed by a third-party entity with a CAMSIZER X2 and through sieve analysis for the coarse fraction (> 1 mm).

Range: 0.01-3000 µm

D10: 9.59 µm **D90:** 873.9 µm

Median(D50): 74.7 µm

Mean: 294.77 µm



2.5 Particle Geometry

Particle geometry measured through Dynamic Image Analysis performed by a third-party entity with a CAMSIZER X2.

Aspect ratio: 0.69451

Root Form Factor/Circularity: 0.86994

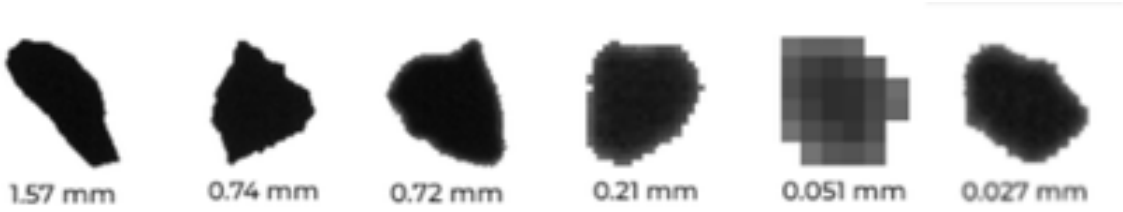


Figure 3: Particle Shape Example at Different Sizes

2.6 Shear Stress - Cohesion (c) and Angle of Internal Friction (φ⁰)

Cohesion and Internal Angle of Friction measured through Direct shear test Performed in combination at UPM-ETSIME by the Space Mining Group with a Mecánica Científica S.A. - Direct Shear Cut Machine and TÜV SÜD's Geotechnics Department with a CONTROLS-CODEIN Model 27-T2 160 Direct Shear Cut Machine following norm UNE-EN ISO 17892-10:2019. Measurements were performed at ~15 kPa, ~25 kPa, ~50 kPa, ~74 kPa and ~98 kPa.

Internal Angle of Friction (φ⁰): 44.58 °

Cohesion (c): 2.503 kPa

2.7 Magnetic Susceptibility

The massive magnetic susceptibility was obtained through a magnetic susceptibility analysis performed by UGR-CIC with a PPMS DynaCool Magnetometer with an ACMS II Module.

χ_m = 7279.5 x10^{-9} m^3/kg

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3. Other Information

- Safety data sheet available on request.
- Available for purchase at **https://www.hispansion.io/shop** for low-volume orders.
- For high-volume orders, reach out at **info@hispansion.io** to check availability and get a personalized quote.
- **Revision date**: March 16th, 2026.