

## Certificate of Analysis

ISO 17034

## Reference Material (RM)

Product ID: MBH-REE-MID-22-P

Product Name: Mid-Level Rare Earth Carbonatite, RM



**Description:** MBH-REE-MID-22-P was made by blending a portion of the LREE ore grade carbonatite used to manufacture MBH-REE-ORE1-22-P with calcium carbonate from Marble Hill Georgia. The final LREE concentration of this material is **0.74 wt%**. Homogeneity testing was performed by WD-XRF following a Li-borate fusion; Assigned values were determined using one or more of the following techniques: WD-XRF, ICP-MS, and/or ICP-OES. LOI (100-1050°C) was determined gravimetrically.

Intended Use: This material is intended for use as an elemental RM for instrument calibration, method development, and the validation of analytical methods.

Assigned Values: Consensus values for the material.

Major Elements (wt%)								
Element	Assigned Value		Oxide	Assigned Value				
Al	0.15		Al <sub>2</sub> O <sub>3</sub>	0.29				
Ba	1.7		BaO	1.9				
Ca	34.4		CaO	48.1				
Ce	0.37		CeO <sub>2</sub>	0.45				
Fe	0.030		Fe <sub>2</sub> O <sub>3</sub>	0.42				
K	0.038		K <sub>2</sub> O	0.045				
La	0.26		La <sub>2</sub> O <sub>3</sub>	0.30				
Mg	1.7		MgO	2.9				
Mn	0.047		MnO	0.061				
Nd	0.089		$Nd_2O_3$	0.10				
Р	0.053		P <sub>2</sub> O <sub>5</sub>	0.12				
Pr	0.031		Pr <sub>6</sub> O <sub>11</sub>	0.038				
S	0.51		SO₃	1.3				
Si	1.2		SiO <sub>2</sub>	2.6				
Sr	0.38		SrO	0.44				
Ti	0.012		TiO <sub>2</sub>	0.019				
LREE**	0.74		LREEO***	0.89				

<sup>\*</sup> Total iron expressed as ferric iron Fe<sub>2</sub>O<sub>3</sub>

<sup>\*\*\*</sup> Light Rare Earth Element Oxides (total)

Trace Elements (mg/kg)									
Element	Assigned Value		Element	Assigned Value		Element	Assigned Value		
Dy	5.6		Pb	383		Th	25		
Eu	10		Rb	1.7		U	3.9		
Но	0.76		Sc	1.5		Υ	21		
Lu	0.15		Sm	61		Yb	0.98		
Nb	5.3								

Loss on Ignition (LOI) 110 °C to 1000 °C: 40.4 wt%



<sup>\*\*</sup> Light Rare Earth Elements (total)



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**Homogeneity:** This material was determined to be homogeneous by procedures consistent with the requirements of ISO 17034 and ISO Guide 35. Replicate samples were selected using stratified random sampling and analyzed in accordance with internal procedures to evaluate homogeneity and stability. To ensure homogeneity, users should not take a smaller sub-sample than specified in the Instructions for Use, as doing so will invalidate the certified values and uncertainties.

Certification: This RM is processed under the scope of accreditation to ISO 17034 by LGC Standards - Manchester, NH. The listed values of this RM are determined by LGC.

Quality Certifications: This CRM was prepared under a quality management system that is accredited to the following:

- ISO 17034:2016 Accredited: Reference Materials Producer, A2LA Certificate No. 2848.02 General Requirements for the Competence of Reference Material Producers
- ISO 17034 references additional requirements specified in ISO Guide 31 and ISO Guide 35
- ISO/IEC 17025:2017 Accredited: Chemical Testing, A2LA Certificate No. 2848.01 General Requirements for the Competence of Testing and Calibration Laboratories
- ISO 9001:2015 Certified: Quality Management Systems, Registrar: TUV NORD Certificate Registration No. 56 100 19560101

Instructions for Use: The powder should be thoroughly mixed and dried at 110°C for 2 hours before analysis. The recommended minimum sample size is 200 mg. This material should be stored tightly capped in a cool dry location when not in use. Minimize exposure to moisture or high humidity.

Period of Validity: The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Health and Safety Information: Refer to the Safety Data Sheet (SDS), which can be obtained at Igcstandards.com

Chuck Goudreau, Certifying Officer

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ISO 17034 Accredited: Reference Materials Producer, Certificate # 2848.02 ISO/IEC 17025 Accredited: Chemical Testing, Certificate # 2848.01