

Certified Reference Material

FLX-2001 – Iron Ore

Certified Values

Parameter	Mass fraction in % ¹⁾	Uncertainty in % ²⁾	Traceable to
Al ₂ O ₃	1,40	0,10	NIST SRM 693
CaO	0,026	0,010 ³⁾	NIST SRM 693
Fe ₂ O ₃	96,47	0,73	NIST SRM 693
Mn ₂ O ₃	0,134	0,021	IV CGMN10 R2-MN694451
P ₂ O ₅	0,202	0,026	NIST SRM 693
SiO ₂	1,67	0,09	BAM Reinstoff 1
TiO ₂	0,134	0,022	IV CGTI10 R2-TI695742

Table1) Certified Values

1) Certified value traceable to SI unit kg/kg based on ignited sample material (1h 950°C).

2) Expanded uncertainty U_{CRM} calculated for a confidence interval of 95% ($k=2$) based on uncertainty of characterization.

3) See minimum sample quantity under Instructions for the correct use of the CRM

The sum of all oxides is **100,10 %**. This includes informational values and excludes LOI.

This certificate is valid, within the uncertainty specified, **until 21.12.2031**, provided the CRM is handled in accordance with instructions given in this certificate. The certification is nullified if the CRM is damaged, contaminated, or otherwise modified.

Bedburg-Hau, **21.12.2021**

Responsible Reference Materials

Susan Aschenbrenner

General Manager

Dr. Rainer Schramm

Description of the CRM

This reference material is an industrial product and was taken directly from the production stream. The complete batch was sealed into 35 g bottles.

Intended use

Calibration and control sample for x-ray fluorescence (XRF) analysis.

Informational Values

Parameter	Mass Fraction in % ³⁾	Uncertainty ⁴⁾
MgO	0,057	-
LOI ⁵⁾	3,49	-

Table2) Informational Values

3) Only Informational Value, not accredited, based on ignited sample material (1h 950°C).

4) Expanded uncertainty U_{CRM} calculated for a confidence interval of 95% ($k=2$) based on uncertainty of characterization, if present, not accredited.

5) Loss on ignition (1h at 950°C) based on original material.

Instructions for the correct use of the CRM

This material is moisture sensitive. This material has to be ignited for minimum 1 hour at 950°C prior use. The ignition process must result in a constant weight. The ignited material must be stored in a desiccator not longer than 24h, then reignition might be necessary. The minimum sample quantity for analysis should be 0,5 g. **For analysis of CaO the minimum sample quantity should be 1 g.**

For XRF use, ignited samples should be prepared as a fused bead, e.g. in accordance with DIN 51001:2003-08 or ISO 9516-1:2003.

Storage Information

The material has to be stored in a dry and clean environment.

Hazardous situation

For this material an actual MSDS is available.

Level of homogeneity

In accordance with ISO Guide 35:2017 a homogeneity study was performed. A one-way ANOVA was used to calculate the batch inhomogeneity.

Stability

In accordance with ISO Guide 35:2017 stability studies were performed. The stability of the material was considered as fit for purpose. The uncertainty of long term stability was calculated.

Total expanded uncertainty

The total expanded uncertainty UCRM for a confidence interval of 95% (k=2) was calculated by taking into account the uncertainty of characterization u_{char} , of inhomogeneity u_{bb} and long-term.

$$UCRM = k \times \sqrt{u_{char}^2 + u_{bb}^2 + u_{lts}^2}$$

Traceability

All of the certified values derived as part of this testing program have traceability to the reference materials stated in table 1.

Methods used

The analytical work performed to assess this material was carried out by the FLUXANA laboratory, which works under DIN EN ISO/IEC 17025:2018 accreditation.

In accordance with DIN EN ISO 17034:2017 and ISO Guide 35:2017, we use the approach stated in DIN EN ISO 17034:2017 Chapter 7.12.3. d) value transfer from an RM to a closely matched candidate RM performed using a single measurement procedure performed by one laboratory.

An example for this approach is found in DIN ISO 13528:2015 E.5. Using this approach, samples of the test material that is to be the new reference material are tested along with matching and/or synthetic RMs using a suitable method. The assigned values X_{CRM} and their uncertainties U_{CRM} are then derived from a calibration against the certified reference values of the compared RMs. Synthetic RMs are made from pure chemicals by weighing.

Measurement method used: XRF with fusion as sample preparation technique.

This certificate is in conformance with ISO Guide 31:2015.