

CERTIFICATE OF ANALYSIS

FLX-CRM 101

Cement

Certified Values

	Mass fraction in % ¹⁾	Uncertainty ²⁾	Traceable to
Al ₂ O ₃	8,86	0,13	NIST 1881b
CaO	48,43	0,20	SI Unit kg/kg
Cr ₂ O ₃	0,011	0,003	NIST 1881b
Fe ₂ O ₃	3,54	0,05	NIST 1881b
K ₂ O	2,10	0,10	SI Unit kg/kg
MgO	1,72	0,06	SI Unit kg/kg
Mn ₂ O ₃	0,116	0,007	NIST 1881b
Na ₂ O	0,657	0,083	NIST 1881b
P ₂ O ₅	0,189	0,008	SI Unit kg/kg
SiO ₂	30,29	0,15	SI Unit kg/kg
SO ₃	3,12	0,14	NIST 1881b
SrO	0,248	0,012	SI Unit kg/kg
TiO ₂	0,463	0,018	NIST 1881b
ZnO	0,046	0,003	SI Unit kg/kg

- 1) Certified value traceable to Cement NIST 1881b and SI unit kg/kg based on ignited sample material (1h at 950°C)
- 2) Expanded uncertainty U_{CRM} calculated for a confidence interval of 95% (k=2) based on uncertainty of characterization.

This certificate is valid, within the uncertainty specified, **until 25.07.2029**, 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, 25.07.2019

Responsible Reference Materials
Susan Aschenbrenner

General Manager
Dr. Rainer Schramm

Description of the CRM

This reference material was produced from commercial product by Heidelberg Cement Ennigerloh, Germany. The material was taken directly from the production stream, and the complete batch was sealed into 50g bottles.

Intended use

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

Informational Values

	Mass Fraction in % ³⁾	Uncertainty ⁴⁾
LOI	5,13	-
Sum of all oxides (ignited sample material)	99,79	-

3) Only Informational Value.

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

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 0.5g.

For XRF use, ignited samples should be prepared as a fused bead, e.g. in accordance with ISO 29581-2:2010.

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

Due to the collected stability data and the long-time experience with this CRM, the uncertainty of inhomogeneities is considered negligible.

Stability

In accordance with ISO Guide 35: 2006 a stability study was performed. As a result, the material was considered as stable. The uncertainty of long term stability u_{lts} was calculated.

Total expanded uncertainty

The total expanded uncertainty U_{CRM} for a confidence interval of 95% ($k=2$) was calculated by taking into account the uncertainty of characterization u_{char} and long-term stability u_{lts} using the following formula:

$$U_{CRM} = k \times \sqrt{u_{char}^2 + u_{lts}^2}$$

Traceability

All of the results derived as part of this testing program have traceability to the SI unit kg.

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 accreditation.

In accordance with ISO 17034 and ISO Guide 35, we use the approach “measurement by a single (primary) method in a single 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 fusion method for materials

Further information

The following table lists all results obtained for this sample material. Values in **bold** represent the results used for the certification.

Users who need all values traceable to a NIST CRM are provided with all results in the following table. However, in comparison with the values traceable to the SI unit, they mostly show a higher uncertainty. For comparison with the certified values. The results of an independently performed proficiency test are also given.

Traceable to NIST1881b		Traceable to SI Unit kg/kg		FLX-CRM 101 Proficiency Test Results (For comparison only)	
Mass fraction in %	Uncertainty (k=2)	Mass fraction in %	Uncertainty (k=2)	Mass fraction in %	Uncertainty (P=95%)
8,86	0,13			8,81	0,05
48,54	0,23	48,43	0,20	48,24	0,15
0,011	0,003			0,010	0,001
3,54	0,05			3,52	0,03
2,12	0,05	2,10	0,10	2,10	0,06
1,74	0,07	1,72	0,06	1,70	0,03
0,116	0,007			0,118	0,002
0,657	0,083			0,68	0,03
0,190	0,008	0,189	0,008	0,191	0,009
30,30	0,16	30,29	0,15	30,31	0,11
3,12	0,14			3,16	0,05
0,243	0,012	0,248	0,012	0,248	0,007
0,463	0,018			0,469	0,005
0,038	0,007	0,046	0,003	0,044	0,003

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