

# Certified Reference Material

## FLX-140

Zirconium Refractory

**New certificate issued January 2021**

### Certified Values

Parameter	Mass fraction in % <sup>1)</sup>	Uncertainty in % <sup>2)</sup>	Traceable to
Al <sub>2</sub> O <sub>3</sub>	1.48	0.05	SI unit kg/kg
CaO	0.056	0.026	SI unit kg/kg
Cr <sub>2</sub> O <sub>3</sub>	0.124	0.006	SI unit kg/kg
HfO <sub>2</sub>	1.92	0.08	BCS-CRM No. 358
K <sub>2</sub> O	0.098	0.004	SI unit kg/kg
La <sub>2</sub> O <sub>3</sub>	0.289	0.019	SI unit kg/kg
MgO	0.204	0.048	SI unit kg/kg
Na <sub>2</sub> O	0.234	0.056	SI unit kg/kg
SiO <sub>2</sub>	0.481	0.089	BCS-CRM No. 358
SrO	0.164	0.018	SI unit kg/kg
TiO <sub>2</sub>	0.169	0.028	BCS-CRM No. 358
ZrO <sub>2</sub>	89.66	0.45	SI unit kg/kg

Table1) Certified Values

1) Certified value traceable to SI unit kg/kg based on ignited sample material for 1h at 1025°C.

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

The sum of all oxides is 99.828. This excludes LOI.

This certificate is valid, within the uncertainty specified, **until 12.10.2030**, 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, **12.01.2021**

**Responsible Reference Materials**  
Susan Aschenbrenner

**General Manager**  
Dr. Rainer Schramm

## Description of the CRM

This reference material is an industrial product. The complete batch was sealed into 50 ml bottles.

## Intended use

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

## Informational Values

	Mass Fraction in % <sup>3)</sup>	Uncertainty <sup>4)</sup>
Y <sub>2</sub> O <sub>3</sub>	4.66	0.16
Fe <sub>2</sub> O <sub>3</sub>	0.292	0.079
LOI	2.67	-

Table2) Informational Values

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 1025°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 DIN EN ISO 12677:2013-02.

## 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 a stability study was performed. As a result, 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  $U_{CRM}$  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 of long-term stability  $u_{lts}$ .

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

## Traceability

All of the results derived as part of this testing program have traceability to the SI unit kg/kg or BCS-CRM No. 358.

## 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.