



**Łukasiewicz**  
Instytut Metali  
Nieżelaznych

## CERTIFICATE OF REFERENCE MATERIAL



RM 006

Si-1  
Silicon

The assigned certified values<sup>1</sup> and uncertainties<sup>2</sup>

|      | Fe           | Al           | Ca            | Ti            | Cr          | Ni         | V           | Mn            | Cu          | P           | B           | C             |
|------|--------------|--------------|---------------|---------------|-------------|------------|-------------|---------------|-------------|-------------|-------------|---------------|
|      | %            | %            | %             | %             | mg/kg       | mg/kg      | mg/kg       | %             | mg/kg       | mg/kg       | mg/kg       | %             |
| Si-1 | <b>1.102</b> | <b>0.270</b> | <b>0.0750</b> | <b>0.0295</b> | <b>33.1</b> | <b>9.0</b> | <b>22.2</b> | <b>0.0237</b> | <b>20.5</b> | <b>53.8</b> | <b>11.7</b> | <b>0.0432</b> |
|      | ±0.043       | ±0.012       | ±0.0031       | ±0.0020       | ±3.5        | ±1.5       | ±3.0        | ±0.0016       | ±2.5        | ±3.1        | ±1.7        | ±0.0066       |

<sup>1</sup> Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination.

<sup>2</sup> The certified uncertainty is the expanded uncertainty with a coverage factor  $k=2$ , corresponding to a level of confidence of about 95 %.

The certified reference material was developed within the SILREF project funded by Norway and state budget and realized by consortium of:

Łukasiewicz Research Network – Institute of Non-Ferrous Metals  
Elkem ASA

Signature

SIEĆ BADAWCZA ŁUKASIEWICZ-  
INSTYTUT METALI NIEŻELAZNYCH  
D Y R E K T O R

dr inż. Barbara Juszczyk, MBA

#### Description of the material:

The certified reference material is available in the form of powder (grain size <1mm).

#### Traceability:

The certified values are traceable to the SI via calibration using pure metals, certified monoelement standard solutions and certified reference materials i.e. IPT 134, IPT 135 Instituto de Pesquisas Technologicas. All values were confirmed in an inter-laboratory comparison using independent analytical methods.

#### Analytical methods applied for characterization:

Inductively coupled plasma optical emission spectrometry (ICP-OES)

Combustion method with IR detection (IR)

Flame atomic absorption spectrometry (FAAS)

Prompt Gamma-Ray Activation Analysis (PGAA)

X-ray Fluorescence spectrometry with wavelength dispersion (WDXRF)

#### Participating laboratories:

|         | Fe                     | Al                  | Ca         | Ti                  | Cr                     | Ni         | V                   | Mn                     | Cu                  | P             | B             | C             |
|---------|------------------------|---------------------|------------|---------------------|------------------------|------------|---------------------|------------------------|---------------------|---------------|---------------|---------------|
| ICP-OES | 1, 2,<br>3, 4,<br>6, 8 | 1, 2,<br>3, 4,<br>8 | 1, 2,<br>4 | 1, 2,<br>3, 4,<br>8 | 1, 2,<br>3, 4,<br>6, 8 | 1, 2,<br>4 | 1, 2,<br>3, 4,<br>8 | 1, 2,<br>3, 4,<br>6, 8 | 1, 2,<br>3, 4,<br>6 | 1, 2,<br>4, 5 | 1, 2,<br>4, 5 |               |
| FAAS    | 2                      | 2                   | 2          |                     |                        |            |                     | 2                      |                     |               |               |               |
| PGAA    | 7                      |                     | 7          | 7                   |                        |            |                     | 7                      |                     |               | 7             |               |
| IR      |                        |                     |            |                     |                        |            |                     |                        |                     |               |               | 1, 4,<br>5, 8 |
| WDXRF   |                        | 1                   |            |                     |                        |            |                     |                        |                     |               |               |               |

1. Łukasiewicz Research Network – Institute of Non-Ferrous Metals, Centre of Analytical Chemistry, Laboratory of Emission Spectrometry and Chromatography, Gliwice, Poland
2. Łukasiewicz Research Network – Institute of Non-Ferrous Metals, Centre of Analytical Chemistry, Laboratory of Atomic Spectrometry, Gliwice, Poland
3. Łukasiewicz Research Network – Institute of Ceramics and Building Materials, Gliwice, Poland
4. Elkem ASA, Kristiansand, Norway
5. REC Solar Holdings AS, Kristiansand, Norway
6. GIG National Research Institute, Katowice, Poland
7. Centre for Energy Research, Hungary
8. Eurofins EAG Materials Science, France

#### Intended use:

The CRM is intended for establishing or checking the calibration of chemical analysis methods, for validation and to demonstrate results traceability of samples with similar matrix composition (not verified for micro-analysis).

#### Minimum sample size:

Minimum 0.2 g of the CRM is required.

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