

# CERTIFICATE OF REFERENCE MATERIAL

## CERTIFICATE OF REFERENCE MATERIAL

LE2  
Tin alloy

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

	<b>Pb</b>	<b>Cd</b>	<b>Hg</b>
	<b>%</b>	<b>%</b>	<b>%</b>
<b>LE2</b>	<b>0.1265</b>	<b>0.01376</b>	<b>0.128</b>
	$\pm 0.0047$	$\pm 0.00057$	$\pm 0.012$

<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 %.

### Not certified values

	<b>Cr</b>
	<b>mg/kg</b>
<b>LE2</b>	<b>42</b>
	$\pm 28$

The information value for Cr is presented as an informative value because of less homogenic distribution of the element in the material

The certified reference material was developed within the REFROHS project funded by targeted subsidy of Łukasiewicz Research Network and realized by consortium of:

Łukasiewicz Research Network – Institute of Non-Ferrous Metals,  
Łukasiewicz Research Network – Institute of Ferrous Metallurgy  
Łukasiewicz Research Network – Cracow Institute of Technology

Certified on November 2022

SIEĆ BADAWCZA ŁUKASIEWICZ-  
INSTYTUT METALI NIEŻELAZNYCH  
Dyrektor Centrum Metalurgii

*dr inż. Tadeusz Gorewoda, MBA*

**Signature**  
SIEĆ BADAWCZA ŁUKASIEWICZ  
INSTYTUT METALI NIEŻELAZNYCH  
DYREKTOR

*dr inż. Barbara Juszczyk*

Version 1 from 30<sup>th</sup> of November 2022

### Description of the material:

The certified reference material is available in the form of discs (40 mm in diameter and ~ 20 mm height).

### Traceability:

The certified values are traceable to the SI via calibration using pure metals, certified monoelement standard solutions or certified reference materials i.e. MBH 71XSR0D, MBH 71XSR1F, MBH 71XSR2F, MBH 74XGE2A, MBH 74XTCF, MBH 74X GE1A, MBH 74X CAD, MBH 74XHNF, MBH 71XSR3, VHG-QC-CHECK-26-100, MBH 74XAMF, MBH 74XCA8B, MBH 74XBZ1A. 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)

Flame atomic absorption spectrometry (FAAS)

Inductively coupled plasma mass spectrometry (ICP-MS)

X-ray Fluorescence spectrometry with energy dispersion (EDXRF)

### Participating laboratories:

	<b>Pb</b>	<b>Cd</b>	<b>Cr</b>	<b>Hg</b>
ICP-OES	1, 2, 3, 7	1, 2, 3, 7	1, 2, 3, 7	1, 2, 3, 7
FAAS	2, 4	2, 4	2, 4	
ICP-MS	2, 5	2, 5	5	2, 5
EDXRF	6			6

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 Ferrous Metallurgy, Laboratory of Analytical Chemistry, Gliwice, Poland
4. Łukasiewicz Research Network – Cracow Institute of Technology, Department of Laboratories, Cracow, Poland
5. J.S. Hamilton Poland Sp. z o.o., Gdynia, Poland
6. Research and Development Center RCC Sp. z o. o., Głuchołazy, Poland
7. Intertek Test Hizmetleri A.S., Istanbul, Republic of Türkiye

### Intended use:

The CRM is intended for establishing or checking the calibration of optical emission or X-ray spectrometers for analysis of samples of similar matrix composition (for micro-analysis is not verified).

### Minimum sample size:

Materials designed for spark-OES spectrometry, XRF spectrometry: >1 mm spot size. For other analytical techniques minimum 0.5 g of the CRM is required.

Instructions for storage and use:

Storage the material in a dry and clean environment at room temperature.  
Transport at normal conditions.

Before every use, the surface of the CRM must be prepared by milling or turning on a lathe. Chips for wet chemical analysis must be taken by turning of the sample surface. Overheating of the material during preparation should be avoided. Samples should be prepared in the same way as the CRM. Such preparation does not result in change of certified values.

Brief description of the production and certification process:

The CRM LE2 was made by melting of all components in a crucible induction furnace and by casting into special moulds protecting elimination of segregation of the components during solidification. Cast was done by the Łukasiewicz Research Network – Institute of Non-Ferrous Metals. Homogeneity testing carried out taking into account about 30% of the produced material. Investigations were carried out using optical emission spectrometry with low voltage spark and XRF techniques. Homogeneity was estimated statistically with application of the ANOVA.

The certification of LE2 is valid 30 years, within the measurement uncertainties specified, provided the CRM is handled in accordance with the instructions given in this certificate.

Expired date:

30 years

Certificate Revision History: 30 <sup>th</sup> of November 2022 (original certificate date)
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Since 2018 our production of the certified reference materials is carried out in accordance with requirements of the ISO 17034 standard.

The Łukasiewicz Research Network —Institute of Non-Ferrous Metals holds an accreditation of the Polish Centre for Accreditation as a reference material producer according to ISO/IEC 17034 with certificate number RM 006.

**Contact:**

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