

**Metal and Quality LLC**  
**Certified Reference Material**  
**Certificate of Chemical Analysis**  
**CA023**  
**Copper**



**APPLICABILITY**

Certified Reference Materials of Copper CA023 is intended for verification of analytical methods, for calibration of analytical instruments based on inert gas fusion methods

**MEAN VALUES OF LABORATORIES**

| Lab. No. | Mass fraction in % |
|----------|--------------------|
|          | O                  |
| 1        | 0.0147             |
| 2        | 0.0153             |
| 3        | 0.0153             |
| 4        | 0.0154             |
| 5        | 0.0154             |
| 6        | 0.0155             |
| 7        | 0.0156             |
| 8        | 0.0158             |
| 9        | 0.0158             |
| 10       | 0.0159             |
| 11       | 0.0159             |
| 12       | 0.0162             |
| 13       | 0.0164             |
| 14       | 0.0166             |
| 15       | 0.0167             |
| 16       | (0.0194)           |
| M(M)     | 0.0158             |
| s(M)     | 0.0006             |

M(M) - Mean of intralaboratory means

s(M) - Standard deviation of the mean values of laboratories

**CERTIFIED VALUES** (mass fraction in %)

| Element                   | O             |
|---------------------------|---------------|
| <b>Certified</b>          | <b>0.0158</b> |
| <b>Uncertainty C(95%)</b> | <b>0.0003</b> |

*Indicative content of Hydrogen is about 0.00021%*

*Uncertainty C(95%) estimated as the half-width confidence interval of Student's t-distribution, when n is the number of laboratory means*

$$C(95\%) = \frac{t \cdot s(M)}{\sqrt{n}}$$

|                      |                                                                                                                                                                                                                                                                                                                                      |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SPECIFICATION</b> | Reference material made of copper as prepared for analysis pins with protective nickel coated diameter of 3.0 mm, weighing 0.5 g                                                                                                                                                                                                     |
| <b>TRACEABILITY</b>  | The characterization of material has been achieved by means interlaboratory experiment in accordance to ISO Guide 35:2006. In each laboratory applied the methods of analysis of their choice                                                                                                                                        |
| <b>HOMOGENEITY</b>   | The homogeneity was evaluated according to ISO Guide 35:2006 (7.7.Evaluating a homogeneity study) and DSTU GOST 8.531:2002 "Reference materials of composition of solid and disperse materials. Ways of homogeneity assessment"                                                                                                      |
| <b>DELIVERY</b>      | Packing - 100 pins in glass bottle and Certificate                                                                                                                                                                                                                                                                                   |
| <b>DATE OF ISSUE</b> | October 2014                                                                                                                                                                                                                                                                                                                         |
| <b>VALID</b>         | October 2027                                                                                                                                                                                                                                                                                                                         |
| <b>SAFETY</b>        | CRM CA023 and packing does not contain explosives and radioactive substances and substances which might influence health and the environment                                                                                                                                                                                         |
| <b>NOTE</b>          | Reference material should be stored in a tightly closed bottle in a dry place. When the bottle is opened for analysis, it should be stoppered immediately after use.<br><br><b>Samples extracted from the bottle using clean metallic tweezers and placed directly into a carefully cleaned weigher and boat devices of analyzer</b> |

#### **PARTICIPATING LABORATORIES**

Alchevsk Iron & Steel Works, Ukraine  
 Azovelectrostal PJSC, Ukraine  
 Asovstal Iron & Steel Works, Ukraine  
 Dneprospetsstal (DSS) OJSC, Ukraine  
 Energomashspetsstal (EMSS) OJSC, Ukraine  
 E.O. Paton Electric Welding Institute, Ukraine  
 Metpromservis LTD, Ukraine  
 OSCAR Production Group, Ukraine  
 Ukrainian Special Steels Institute (USSI) SE, Ukraine  
 Zaporizhstal Steel Works, Ukraine  
 Element Materials Technology, USA  
 Institute for Certified Reference Materials (ICRM), RU  
 Institute for Ferrous Metallurgy (IMZ), Poland  
 ENVIFORM a.s., Czech Republic  
 LECO European Technical Centre Prague, Czech Republic  
 ŽĎAS a.s., Czech Republic

#### **THE METHODS USED**

Inert gas fusion: chromatography with thermal conductivity (USSI), with infrared absorption – rest laboratories

CRM CA023 registered in the Register of the Ministry of Industrial Policy of Ukraine under number GSZU 3-234-2014(2)

#### **CONTACTS**

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