



## Reference Material Certification

### Copper of attested oxygen content Cu 600/I

The reference material is intended for calibration of automatic analysers for determination of oxygen content in copper.

A single container holds eight rods 10.5 cm long and 6 mm in diameter, of a total mass 220 g +/- 5 g.

**Certified values:** The certified value is presented in Table 1. It was calculated basing on results from eight laboratories participating in the attestation.

**Storage:** The material should be kept in the original container. It should not be exposed to the action of acid vapours.

**Usage:** The reference material should be used for analysis in a form of a weighted amount, of a mass not lower than 0.4 g. The samples should be prepared directly before the analysis, through cleaning of the surface by turning or etching in solution of nitric acid (V) and water in ratio 8:2.

**Origin of the material and a method of its preparation:** The reference material was manufactured from copper rods of diameter 9 mm, produced at H. M. Cedynia. Determined by the producer oxygen content was close to the level planned by the authors of the project. The copper rods were then subject to plastic working to receive rods 6 mm in diameter and 2 m long. After confirmation of the planned level of oxygen content, the material was subject to further examination, like homogeneity examination and interlaboratory attestation.

**Determination of homogeneity:** Homogeneity of the reference material was examined in IMN laboratory by making five determinations of oxygen content in the samples taken at random from 19 rods (17% of all the rods) with a use of Leco RO-316 analyser. The obtained set of results was evaluated statistically by F-Snedecor test. Calculated value of the F-Snedecor factor was smaller than the critical value given in tables, which is a proof of homogeneity of the material.

**Stability of the reference material:** The produced reference material is stable. Institute of Non-Ferrous Metals controls certified oxygen content on a regular basis. If a deterioration in the certified properties occurs, the customers will be notified immediately.

Table 1. **Certified value [ppm]**

<b>Element</b>	<b>Content</b>	<b>Uncertainty*</b>
<b>Oxygen</b>	<b>581</b>	12*

\*/ Coverage factor k of expanded uncertainty is 2.45

#### **Analytical methods used in certification**

Method of reduction melting in the inert atmosphere

#### **Analytical chemists of IMN participating in preparation and certification of the reference material**

- Zofia Mzyk
- Jan Mzyk
- Łucja Buzek

#### **Laboratories participating in the attestation**

- Centrum Badań Jakości Sp. z o.o. (Quality Control Centre) 3 laboratories: WBJ-1 Głogów I and Głogów II, WKJ-2
- Hutmen S. A.,
- Institute of Non-Ferrous Metals – Laboratory L-3
- Non-Ferrous Metals Works Szopienice,
- Institute of Ferrous Metallurgy,
- KGHM Polska Miedź, S. A. Copper Smelter “Cedynia”.

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