EUROPEAN COMMISSION
JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements

CERTIFIED REFERENCE MATERIAL
BCR® – 054R

CERTIFICATE OF ANALYSIS

COPPER		
	Mass fraction	
	Certified value [1] [mg/kg]	Uncertainty [2] [mg/kg]
Oxygen	0.47	0.07

[1] This is the mean result of 11 determinations by charged particle activation analysis applied as a primary method in a single laboratory and confirmed by fusion extraction. The certified value is traceable to the International System of Units (SI).

[2] The certified uncertainty is the expanded uncertainty estimated in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM) with a coverage factor k = 2, corresponding to a level of confidence of about 95 %.

This certificate is valid for three year after purchase.

Sales date:

The minimum amount of sample to be used is 100 mg.
The surface oxygen depends on the surface area as well as on the mechanical and chemical treatment (see INSTRUCTIONS FOR USE).

DESCRIPTION OF THE SAMPLE

The material is available in the form of rods with 7 mm diameter and 50 mm length, sealed under argon in cold welded aluminium tubes.

NOTE

This material has been certified by BCR (Community Bureau of Reference, the former reference materials programme of the European Commission). The certificate has been revised under the responsibility of IRMM.

Brussels, November 1988
Revised: May 2007

Signed: 

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ANALYTICAL METHOD USED FOR CERTIFICATION

- Charged particle activation analysis
- Fusion extraction (for confirmation, not for certification)

PARTICIPANTS

- European Commission, Joint Research Centre, Central Bureau for Nuclear Measurements (CBNM), Geel (BE)
- CNRS, Centre d'Etudes et de Recherches par Irradiation, Orléans (FR)
- Institut für Kernphysik der J.W. Goethe Universität, Frankfurt (DE)
- Instituut voor Nucleaire Wetenschappen, Rijksuniversiteit Gent, Gent (BE)
- Kabel- und Metallwerke Gutehoffnungshütte, Osnabrück (DE)
- Max-Planck-Institut für Metallforschung, Dortmund (DE)

SAFETY INFORMATION

The usual laboratory safety precautions apply.

INSTRUCTIONS FOR USE

The certified value and the uncertainty relate to the oxygen in the bulk of the metal only; the analytical method used does not include the oxygen present at the surface.
As other methods of analysis will normally include the oxygen present at the surface, the users should treat the sample as given in Appendix 1 in order to minimise the surface oxygen.

STORAGE

The material can be stored at room temperature.
However, the European Commission cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially of opened samples.

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NOTE

A technical report on the production of BCR–054R is available on the internet (http://www.irmm.jrc.be). A paper copy can be obtained from IRMM on request.

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APPENDIX 1 (reprinted from report EUR 6602)

RECOMMENDED SURFACE TREATMENT FOR COPPER

TURNING ON A LATHE

Tool material: High speed steel

Design: Annex 1

Tool parameters

κ : 45 °

γ : 20 – 30 °

α : 6 – 10 °

α_1 : 3 – 6 °

λ : 0 °

Top radius: 0.2 to 0.3 mm

Turning parameters (Workpiece Ø : 30 mm)

Cutting speed (rpm) : 1000 - 1500

Pre-turning

Feed (mm/revol): 0.5 - 1

Depth of cut (mm): 0.5 - 1

Final-turning

Last 0.1 to 0.2 mm:

Feed (mm/revol): 0.01 – 0.02

Depth of cut (mm): 0.05 – 0.1

Cutting fluid: Kerosene

SUBSEQUENT CHEMICAL ETCHINGS

Bath 1	:	1 Vol HCl (min. 30 %; d $\simeq$ 1.15)
Temperature	:	20 °C
Duration	:	2 – 3 min
Arrest	:	3 x H_20
Bath 2	:	1 Vol HNO_3 (min. 65 %; d $\simeq$ 1.4) + 1 Vol CH_3COOH (min. 96 %; d $\simeq$ 1.06) + 1 Vol H_3PO_4 (min. 85 %; d $\simeq$ 1.71)
Temperature	:	20 °C
Duration	:	1 min
Arrest	:	3 x H_20
Drying	:	3 x CH_30H + hair drier ($\pm$ 60 °C)

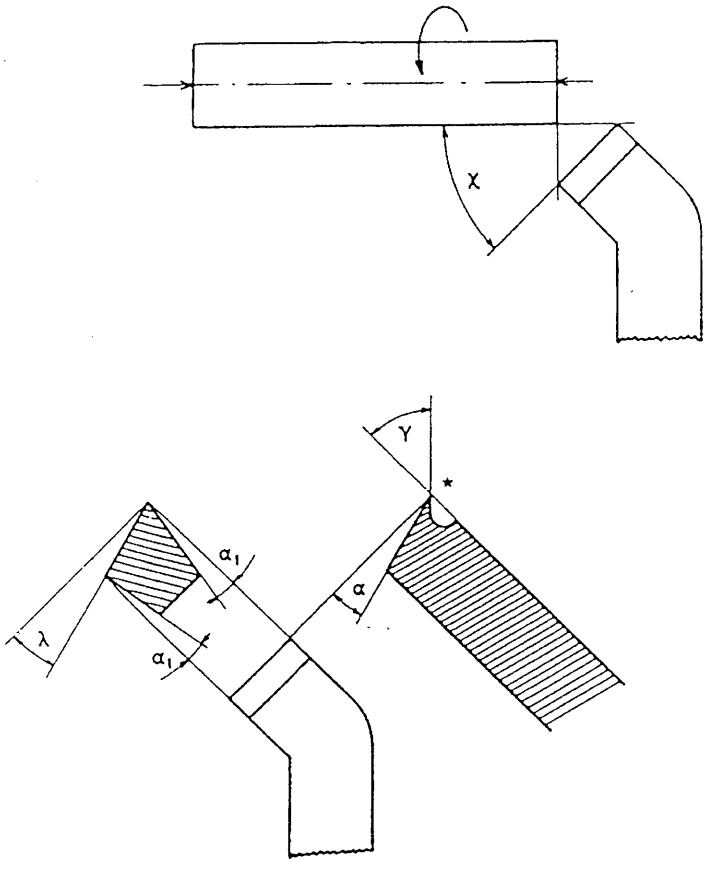
COMMENTS

Turning on a lathe is essential but chemical etching is not.

TYPICAL RESIDUAL SURFACE CONTENTS

0 : 0.2 to 0.4 µg/cm^2

Annex 1: Design



Tool parameters for turning

κ : Angle of attack

γ : Clearance angle

α : Rake angle

α_1 : Rake angle

λ : Inclination cutting edge

* : Top radius