

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 454

Unalloyed Copper - Cu XI

(In Cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of small ground chips, sized between 0.15 mm and 0.84 mm sieve openings (100 - 20 mesh). The SRM is intended for use in trace analysis of copper materials. It is designed for all techniques applicable to compositional analysis of unalloyed copper and it is particularly well suited for calibration with optical emission methods of analysis.

Element	Certified Value ^a μg/g	Estimated Uncertainty ^b	Element	Certified Value ^a μg/g	Estimated Uncertainty ^b
Antimony ^c	24	2	Selenium ^c	479	16
Arsenic ^c	46	4	Silver ^c	286	3
Bismuth ^d	19	3	Tellurium ^c	27	1
Gold ^d	7.5	0.5	Tin ^d	2.2	0.8
Lead ^e	66	5	Zinc ^c	7	2
Element	Certified Value ^a		Estimated Uncertainty ^b		
Copper, assay ^f	99.84		0.02		

^aThe value listed for an element is the *present best estimate* of the "true" value based on the results of the analytical program for certification.

^bThe estimated uncertainty listed for an element is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability for samples of 1.0 g or more.

^cValues for Sb, As, Se, Te, and Zn are based on agreement of determinations at NBS and at cooperating laboratories.

^dValues for Bi, Au, and Sn are based on agreement of determinations at cooperating laboratories.

^eValues for Pb and Ag are based on determinations at NBS by isotope dilution mass spectrometry.

^fValue for Cu is based on determinations at NBS by electrogravimetry (corrected for Ag).

The overall coordination of the NBS analytical measurements leading to certification was under the direction of I.L. Barnes.

The technical and support aspects involved in the issuance of this SRM were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

PLANNING, PREPARATION, TESTING, ANALYSIS:

This material is one in a series of twelve different composition copper "Benchmark" materials, Cu "O" through Cu XI, that are being prepared in a cooperative Industry-ASTM-NBS Program.

The material for the preparation of Cu XI was supplied by the Magma Copper Company, San Manuel Division, San Manuel, Ariz., courtesy of T.L. Young. Selected anode material from fire-refined copper was drilled with a 12.7 mm (1/2 in) drill to provide chips that were then ground using a liquid coolant. The resulting material was screened to remove particles larger than 0.84 mm (20 mesh), which were reground to pass through the sieve. Particles finer than 0.15 mm (100 mesh) were discarded.

At NBS, the material was thoroughly blended. The results of homogeneity testing indicated material variability to be less than 10%.

Cooperative analyses were performed in the following analytical laboratories:

Anglo American Corporation of South Africa Limited, Johannesburg, Republic of South Africa, R. Murray-Smith.
Magma Copper Company, San Manuel, Ariz., S.K. Young.

South African Bureau of Standards, Physical Chemistry Division, Pretoria, Republic of South Africa, H.P. Beyers and P.G. Odendaal.

Analyses were performed in the NBS Inorganic Analytical Research Division by the following: K.A. Brletic, B.I. Diamondstone, J.D. Fassett, E.L. Garner, J.W. Gramlich, W.R. Kelly, G.J. Lutz, L.A. Machlan, J.R. Moody, and R.K. Bell, ASTM-NBS Assistant Research Associate.

ADDITIONAL INFORMATION:

Analysts should use the ground chips in the "as received" condition. Some surface oxidation (discoloration) may be present, but the amount is not analytically significant for the elements certified. The analyst should keep the container tightly capped when not in use.

Elements other than those certified are present in this material as indicated below. These are *NOT CERTIFIED*, but are given as additional information on the composition.

Element	Information Value, $\mu\text{g/g}$
Cobalt	(4)
Iron	(50)
Nickel	(150)
Palladium	(0.1)