U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1034

Unalloyed Copper

(In cooperation with the American Society for Testing & Materials)

This Standard Reference Material (SRM) is in the form of rods, 6.35 mm (0.250 in) in diameter and 103 mm (4 in) long, and is intended for use in calibrating instruments used in the determination of sulfur in unalloyed copper and copper-base alloys.

Determination of Sulfur

Lab	Method[a]	Certified Value, ppm by wt	Estimated Uncertainty
NBS	Isotope Dilution-Thermal Ionization Mass Spectrometry (ID-TIMS)	2.8[b]	0.2[c]

Cooperating Labs	Method	Reported Average Value, ppm by wt[d]
1	Combustion-Infrared	(2.4)
2	Combustion-Infrared	(3.6)
3	Combustion-Infrared	(3.0)
4	Combustion-Infrared	(3.0)
5	Combustion-Infrared	(2.8)
6	Combustion-Infrared	(3.5)

[a] ID-TIMS - In this method, all sources of measurement error, including blank, have been investigated fully, and the certified value is believed to be free from systematic error, P. J. Paulsen and W. R. Kelly, Inorganic Analytical Research Division.

[b] The certified value is the *present best estimate* of the "true" value based on the results at NBS by using the ID-TIMS method.

[c] The estimated uncertainty is based on judgment and represents an evaluation of the combined effects of method imprecision and material variability (1 g or more).

[d] Cooperating laboratories were furnished a portion of SRM 52c, Cast Bronze (now out of stock), with an assigned value of 20 ppm of sulfur, for calibration of their equipment. The determined value for sulfur in SRM 52c is 19.8 ppm by ID-TIMS. If a linear correction is assumed for SRM 1034, the corrected average would be 2.8 ppm of sulfur, which is in excellent agreement with the certified value of 2.8 ppm.

Washington, D.C. 20234
February 3, 1982

George A. Uriano, Chief
Office of Standard Reference Materials

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PLANNING, PREPARATION, TESTING, ANALYSIS: The material for this standard was provided by the Magma Copper Co., San Manuel, Ariz., courtesy of T. L. Young.

Homogeneity testing was performed at Kennecott Refining Corp., Baltimore, Md., by optical emission spectrochemical analysis, A.A. DiLeonardi; at NBS (Boulder) by residual resistivity ratio measurements, J.G. Hust; and at NBS (Washington) by chemical analysis: I.L. Barnes, R.W. Burke, B.I. Diamondstone, M.G. Dias, L.P. Dunstan, E.L. Garner, L.A. Geldner, J.W. Gramlich, G.J. Lutz, L.A. Machlan, T.J. Murphy, P.J. Paulsen, P.A. Sleeth, and by R.K. Bell, ASTM-NBS Assistant Research Associate.

Cooperative analyses were performed in the following laboratories:

American Cast Iron Pipe Co., Birmingham, Ala., R.N. Smith and L.J. Moore.

Kennecott Minerals Co., Research Center, Salt Lake City, Utah, A.P. Langheinrich.

Magma Copper Co., San Manuel Division, San Manuel, Ariz., M. Greene and M. Toelkes.

Phelps Dodge Refining Corp., El Paso Works, El Paso, Texas, A.L. Cardinal.

U.S. Bureau of Mines, Albany Research Center, Albany, Oreg., A.J. Mackie and D.H. Bollman.

Western Electric, Hawthorne Station, Chicago, Ill., J.P. Kapetan.

The overall coordination of the technical measurements leading to certification were performed under the direction of J.I. Shultz, Research Associate, ASTM-NBS Research Associate Program.

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

SRM 1034 is from the original lot of material used for SRM 457, Unalloyed Copper - Cu IV. Although *not certified,* the following data are given as additional information on the composition:

SRM	Cu Wt %	Sb	As	Bi	Fe	Pb	Mn	Ni	Se	Ag	Te
		Parts Per Million by Weight									
1034	(99.96)	(0.2)	(0.2)	(0.2)	(2.0)	(0.5)	(<0.1)	(0.6)	(3.3)	(8.1)	(0.5)

SRM 1034 (Cont'd)	Sn	Zn	Al	Cd	Cr	Co	Au	Mg	O	Si
	Parts Per Million by Weight									
	(<0.2)	(<11)	(<2)	(<1)	(0.3)	(0.2)	(<0.05)	(<1)	(363)	(<2)