U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

Certificate of Analysis

Standard Reference Material 685

High–Purity Gold

This standard is provided as a reference source of gold of high purity. It is issued in two forms, wire and rod.[1] The wire form is intended for applications such as spark–source mass spectrometry where the low level of impurities in the standard should make it useful for evaluating instrument and system blanks. The rod form is intended for use in other methods of characterization and in other scientific applications.

INFORMATION ON THE COMPOSITION

	SRM No. 685–W		SRM No. 685–R	
Element	Best Indicated Value	Range of Values Reported[2]	Best Indicated Value	Methods of Analysis[3]
	(Concentration in Parts per Million by Weight)			
Copper	0.1	(<0.1 – 0.26)	0.1	a, b, c, d
Indium	0.00_7	(0.002 – 0.014)	0.00_7	a, d
Iron	0.3	(0.16 – 0.50)	0.2	b, c, d
Oxygen	[2][4]	(1.5 – 3.0)	[<2]	e
Silver	[0.1]	(0.05 – 0.11)	[0.1]	d

1. SRM No. 685–W is in the form of wire 1.4 mm (0.055 inch) in diameter and 10.2 cm (4 inches) long.
   SRM No. 685–R is in the form of rod 5.9 mm (0.23 inch) in diameter and 2.5 cm (1 inch) long.
2. The range of values reported is the extreme variation of the individual results from the methods of analysis used. The "best indicated value" is based on consideration of the estimated systematic bias of each of the methods employed.
3. Methods of Analysis:
   a. Neutron Activation Analysis (W. D. Kinard, D. A. Becker, P. D. LaFleur)
   b. Polarography (E. J. Maienthal)
   c. Spectrophotometry (T. A. Rush, D. H. Christopher, R. W. Burke)
   d. Spark–Source Mass Spectrometry – Isotopic Dilution (P. J. Paulsen, D. E. Kelleher, R. Alvarez)
   e. Vacuum Fusion (J. T. Sterling)
4. Values in brackets are possibly subject to greater error since only one method of analysis was employed.

The overall direction and coordination of the technical measurements leading to certification were performed under the chairmanship of B. F. Scribner.

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

Washington, D.C. 20234
October 1, 1981
(Revision of Certificate
dated 9/26/68)

George A. Uriano, Chief
Office of Standard Reference Materials

(over)

This standard has been established to provide a homogeneous reference material of high-purity gold primarily for application in spark–source mass spectrometry. It should also be of interest to the chemist, physicist, and materials engineer since gold has numerous scientific and industrial applications, especially in the electronics industry. The material should serve for the development of new or improved methods and techniques in extending the sensitivity of detection in the determination of trace constituents by chemical, optical emission, spark–source spectrochemical, activation, and resistivity methods. The material was prepared by Cominco American, Inc. from a special lot of highly purified gold which was homogenized and processed into the wire and rod forms.

In the course of analysis by spark–source mass spectrometry (P. J. Paulsen, D. E. Kelleher), other elements were found to be present. These are listed below with an estimated upper limit of concentration in parts per million by weight. Because of possible contamination at these extremely low levels of concentration, some of the elements listed may not arise from the gold itself. The concentrations were estimated from relative sensitivity coefficients computed by assigning all elements the same atomic sensitivity as gold and correcting for the variation of photographic plate sensitivity with mass.

Al	<0.3	K	<0.2	S	<0.07
Ba	< .03	Mg	< .2	Sc	< .01
C	< .1	Mn	< .01	Si	< .3
Ca	<1 (est 0.1)	N	< .03	Sn	< .07
Cl	<0.1	Na	< .2	Sr	< .03
Cr	< .05	Nb	< .1	V	< .05
F	< .02	Ni	< .05	Zn	< .04

No other elements were detected with most having estimated limits of detection in the range of 0.01 to 0.05 ppm.

Extensive homogeneity testing was performed at the NBS laboratories in Gaithersburg, Md., and in Boulder, Colo., and the material was found to be satisfactory within the limits of precision of the analytical methods used. The samples selected for testing were chosen to represent the extreme variations that might be expected as a result of the preparation procedures. However, practical limitations precluded testing the number of samples of the wire and rod material that would have been required to guarantee absolute limits of homogeneity. The testing was performed by using combinations of the methods of analysis indicated under footnote 3 (see over), but also including optical emission spectrochemical analysis (R. Alvarez), and electrical measurements for residual resistivity ratios (J. C. Moulder, V. A. Deason, R. L. Powell).

CAUTION

Before use, it is recommended that possible surface contamination be removed by placing the sample in warm aqua regia (3 HCl + 1 HNO_3) for approximately five minutes, and then followed by rinsing in distilled water.