National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Materials

614, Trace Elements in a Glass Matrix (3 mm Wafer)
615, Trace Elements in a Glass Matrix (1 mm Wafer)

(Nominal Trace Element Concentration 1 mg/kg (ppm))

These Standard Reference Materials (SRMs) were produced and certified to facilitate the development of chemical methods of analysis for trace elements and is one of a series of four pairs of SRMs. For both SRMs, 614 and 615, the nominal trace element concentration is 1 mg/kg for each of the sixty-one elements that have been added to the glass support matrix. The two SRMs differ only in the thickness of the glass wafer. Units of SRMs 614 and 615 are issued as sets of six wafers.

(Certified Values are Listed on Page 2)

These materials were prepared in rod form and have been sliced into wafers. The rods were hand-pulled, and therefore are not uniform over their length. Each wafer is oval to circular in cross-section, with a nominal diameter of 12-14 mm. The certified values are for an entire wafer (no fragment thereof). The debris from wafering has been only partially removed and each wafer should be surface cleaned before use. The first step in preparing the wafer for analysis is to wipe it clean with alcohol, and then to give it a mild surface cleaning (not etch) in dilute (1:10) nitric acid. The wafers were cut with a copper-bonded diamond wheel and the nitric acid step is included to remove any possible copper contamination.

Considerable care and effort have gone into the manufacturing of these SRMs to ensure homogeneity. The target level of precision and accuracy for certification of these materials was 10 percent or better. To date no element has been proven to be heterogeneous outside this limit for the SRM wafer used in its entirety. However, spatial inhomogeneity does exist within each wafer. For certification, two or more methods or laboratories must agree to at least the target level.

The overall direction and coordination of the technical measurements leading to certification were performed under the chairmanship of W.R. Shields.

The technical and support aspects involved in the original preparation, certification, and issuance of these Standard Reference Materials were coordinated through the Standard Reference Materials Program by J.L. Hague. Revision of this certificate was coordinated through the Standard Reference Materials Program by J.S. Kane.

This Certificate of Analysis has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented in this certificate.

Gaithersburg, MD 20899
January 27, 1992
(Revision of certificate dated 1-4-82)

William P. Reed, Chief
Standard Reference Materials Program

(over)

A listing of the 61 elements added and the present status of the analytical certification are given in the following table. An asterisk before the element indicates a certified concentration for that element. The indicated limits on the concentration are equal to the entire range of observed results among sample points and/or the 95 percent confidence interval, whichever is larger. Values in parentheses are information values, and are not certified for the reasons given in the footnotes. Nominal composition of the support matrix is 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.

Element	Value	Notes	Element	Value	Notes
Antimony	(1.06)	1,a	Boron	(1.30±0.2)	2,b
Arsenic	--		Cadmium	(0.55)	3,c
Barium	--		Cerium	--	
Beryllium	--		Cesium	--	
Bismuth	--		Chlorine	--	
Chromium	--		Europium	(0.99±0.04)	4,a
Cobalt	(0.73±0.02)	4,d	Fluorine	--	
*Copper	1.37±0.07	5,c,g	Gadolinium	--	
Dysprosium	--		Gallium	(1.3)	1,a
Erbium	--		Germanium	--	
Gold	(0.5)	1,a,d	Lanthanum	(0.83±0.02)	4,d
Hafnium	--		*Lead	2.32±0.04	7,f,g
Holmium	--		Lithium	--	
Indium	--		Lutetium	--	
Iron	(13.3±1)	6,e	Magnesium	--	
Manganese	--		Phosphorus	--	
Molybdenum	--		*Potassium	30±1	8,g,h
Neodymium	--		Praseodymium	--	
Nickel	(0.95)	6,e	Rhenium	--	
Niobium	--		*Rubidium	0.855±0.005	9,g,h
Samarium	--		Sulfur	--	
Scandium	(0.59±0.04)	4,d	Tantalum	--	
Selenium	--		Tellurium	--	
*Silver	0.42±0.04	10,c,d	Terbium	--	
*Strontium	45.8±0.1	11,g,j,k	Thallium	(0.269±0.005)	12,g
*Thorium	0.748±0.006	13,f,g	*Uranium	0.823±0.002	14,b,f,g
Thulium	--		Vanadium	--	
Tin	--		Ytterbium	--	
Titanium	(3.1±0.3)	6,e	Yttrium	--	
Tungsten	--		Zinc	--	
			Zirconium	--	

(All values given in table are in mg/kg (ppm) by weight.)

NOTES:

1. Neutron activation: one method only with an apparently large systematic error (>10%) for this element because of poor correlation among measurements at various concentrations.
2. Nuclear track counting: one method only, but with very good correlation interpolating between concentrations.
3. Spark source isotope dilution: one method only.
4. Neutron activation: one method only.
5. Pooled data: spark source isotope dilution and thermal ionization isotope dilution.
6. Polarographic: one method only.
7. Pooled isotope dilution data: value from USGS accepted because of smaller error limits and substantiated by NIST.
8. Pooled data: NIST flame emission data substantiated by NIST isotope dilution.
9. Isotope dilution data substantiated by flame emission which has a much larger uncertainty statement (range).
10. Pooled data: spark source isotope dilution plus neutron activation.
11. Pooled data: NIST isotope dilution data accepted and substantiated by USGS and Australian National University. The normalized $^{87}Sr/^{86}Sr$ ratio = 0.7083±0.0002.
12. Isotope dilution: one method only with good correlation interpolating between concentrations.
13. Pooled isotope dilution data: value from NIST accepted because of smaller error limits and substantiated by USGS.
14. Isotope dilution: NIST isotope dilution data used, substantiated by USGS isotope dilution and NIST nuclear track counting data which both had slightly higher uncertainties. Uranium in glass depleted in ^{235}U. The atom percent ^{235}U = 0.2792.

a. Neutron activation - H.L. Rook
b. Nuclear track counting - B.S. Carpenter
c. Spark source isotope dilution - P.J. Paulsen
d. Neutron activation - B.A. Thompson
e. Polarography - E.J. Maienthal
f. Isotope dilution - M. Tatsumoto, Isotope Geology Branch, USGS, Federal Center, Denver
g. All isotope dilution analysis at NIST by staff, Analytical Mass Spectrometry Group
h. Flame emission - T.C. Rains
j. Isotope dilution - C. Hedge, Isotope Geology Branch, USGS, Federal Center, Denver
k. Isotope dilution - W. Compston, Australian National University, Canberra