

National Bureau of Standards

Certificate of Analysis

Standard Reference Materials

616 3 mm Thick Wafers

617 1 mm Thick Wafers

Trace Elements in a Glass Matrix

(Nominal Trace Element Concentration 0.02 ppm)

This Standard Reference Material was produced and certified to facilitate the development of trace analytical methods, and is one of a series of four. The nominal trace element concentration is 0.02 ppm for each of the sixty-one elements that have been added to the glass support matrix.

(Certified Values are Listed on Page 2)

This material was prepared in rod form and has been sliced into wafers. The certified values given 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 this Standard Reference Material to ensure homogeneity. The target level of precision and accuracy for certification on this material was 10 percent or better. To date no element has been proven to be outside this limit for the segment of rod used as the SRM. For those elements that are a particulate suspension in a glass matrix, a certain amount of heterogeneity is expected. 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 preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by J. L. Hague.

Washington, D.C. 20234
January 4, 1982
(Revision of Certificates dated
8/5/70 & 8/8/72)

George A. Uriano, Chief
Office of Standard Reference Materials

(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 interim for the reasons given in the footnotes. Nominal composition of the support matrix is 72% SiO₂, 12% CaO, 14% Na₂O, and 2% Al₂O₃.

<u>Element</u>	<u>Value</u>	<u>Notes</u>	<u>Element</u>	<u>Value</u>	<u>Notes</u>
Antimony	(0.078±0.007)	1,a	Boron	(0.20±0.02)	2,b
Arsenic	---		Cadmium	---	
Barium	---		Cerium	---	
Beryllium	---		Cesium	---	
Bismuth	---		Chlorine	---	
Chromium	---		Europium	---	
Cobalt	---		Fluorine	---	
Copper	(0.80±0.09)	3,a	Gadolinium	---	
Dysprosium	---		Gallium	(0.23±0.02)	1,a
Erbium	---		Germanium	---	
Gold	(0.18±0.01)	1,a	Lanthanum	(0.034±0.007)	3,a
Hafnium	---		*Lead	1.85±0.04	5,d,e
Holmium	---		Lithium	---	
Indium	---		Lutetium	---	
Iron	(11±2)	4,c	Magnesium	---	
Manganese	---		Phosphorus	---	
Molybdenum	---		*Potassium	29±1	6,e,f
Neodymium	---		Praseodymium	---	
Nickel	---		Rhenium	---	
Niobium	---		Rubidium	(0.100±0.007)	7,e
Samarium	---		Sulfur	---	
Scandium	(0.026±0.012)	3,a	Tantalum	---	
Selenium	---		Tellurium	---	
Silver	---		Terbium	---	
*Strontium	41.72±0.05	8,e,f	Thallium	(0.0082±0.0005)	9,e
*Thorium	0.0252±0.0007	10,d,e	*Uranium	0.0721±0.0013	11,b,d,e
Thulium	---		Vanadium	---	
Tin	---		Ytterbium	---	
Titanium	(2.5±0.7)	4,c	Yttrium	---	
Tungsten	---		Zinc	---	
			Zirconium	---	

(All values given in table are in 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 extrapolating down from 1 ppm glass.
 3. Neutron activation: one method only with good correlation extrapolating down from 1 ppm glass.
 4. Polarographic: one method only with good correlation extrapolating down from 1 ppm glass. The large uncertainty is due to a large chemical blank.
 5. Pooled isotope dilution data: value from USGS accepted because of smaller error limits and substantiated by NBS.
 6. Pooled data: NBS flame emission data substantiated by NBS isotope dilution.
 7. Isotope dilution: one method only with good correlation extrapolating down from 1 ppm glass. The uncertainty statement (range) is the result of one sample point which gave a result 0.005 ppm higher than the average.
 8. Pooled data: NBS isotope dilution data accepted and substantiated by NBS flame emission. The normalized $^{87}\text{Sr}/^{86}\text{Sr}$ ratio = 0.7080 ± 0.0002 .
 9. Isotope dilution: one method only with good correlation extrapolating down from 1 ppm glass.
 10. Pooled isotope dilution data: value from NBS accepted because of smaller error limits and substantiated by USGS.
 11. Pooled data: NBS and USGS isotope dilution data and NBS nuclear track counting all weighted equally. Uranium in glass depleted in ^{235}U . The atom percent $^{235}\text{U} = 0.616$.
- a. Neutron activation - H. L. Rook
 - b. Nuclear track counting - B. S. Carpenter
 - c. Polarography - E. J. Maienthal
 - d. Isotope dilution - M. Tatsumoto, Isotope Geology Branch, USGS, Federal Center, Denver
 - e. All isotope dilution analysis at NBS by staff, Analytical Mass Spectrometry Section
 - f. Flame emission - T. C. Rains