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 679

Brick Clay

This Standard Reference Material (SRM) is intended for use in the determination of constituent elements in clay or materials of a similar matrix. SRM 679 consists of brick clay that was air-dried, ball milled, and passed through a 200-mesh sieve.

Certified Values of Constituent Elements

The certification of this SRM is based on analyses using a minimum sample size of 250-mg of the dried material as indicated under "Instructions for Drying". The certified values of the constituent elements and the methods used for certification are given in Table 1. The certified values are based on measurements using two or more independent reliable analytical techniques and/or methods. Non-certified values for information only are given in Table 2. For user convenience, gravimetric multipliers for the conversion of the elemental concentrations to "equivalent" oxide concentrations are given in Table 3.

Instructions for Drying

The certification of the constituent elements in this SRM is based upon a properly dried sample. The recommended procedure is to dry in a conventional oven for two hours at 105 °C. Typical moisture loss is expected to be ≤ 3%.

Certification analyses were performed by M.J. Blackman, Smithsonian Institution, K.A. Brletic, M.S. Epstein, J.W. Gramlich, R.E. Jenkins, P.J. Paulsen, J.R. Moody, and T. W. Vetter of the Inorganic Analytical Research Division, and P.A. Pella, J. Sieber, G. Sleater, and Z. Wang of the Gas and Particulate Science Division.

The statistical analysis of the certification data was performed by K.R. Eberhardt of the Statistical Engineering Division.

The overall direction and coordination of the technical activities were performed under the chairmanship of J.R. DeVoe, Chief of the Inorganic Analytical Research Division.

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 T.E. Gills.

Gaithersburg, MD 20899
January 14, 1987

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(Over)

Table 1. Certified Values of Constituent Elements

Element	Content[1], wt%	Element	Content, $\mu g/g$
Aluminum[c,e,g]	11.01 ± 0.34	Barium[a,e]	432.2 ± 9.8
Calcium[f,g]	0.1628 ± 0.0013	Chromium[a,e]	109.7 ± 4.9
Iron[b,c,e,g]	9.05 ± 0.21	Lithium[c,f]	71.7 ± 6.2
Magnesium[a,f]	0.7552 ± 0.0088	Strontium[a,f]	73.4 ± 2.6
Potassium[f,g]	2.433 ± 0.047		
Silicon[a,d,g]	24.34 ± 0.30		
Sodium[c,e]	0.1304 ± 0.0038		
Titanium[a,g]	0.577 ± 0.033		

[1]The certified value is a weighted mean of results from two or more analytical techniques. The weights for the weighted means were computed according to the iterative procedure of Paule and Mandel (*NBS Journal of Research 87*, 1982, pp. 377-385). The uncertainty of the certified value is a 95% expected coverage tolerance interval for the concentration in a minimum sample size of 250 mg of this SRM, plus an additional allowance for systematic error among the methods used.

Methods

a. Direct-Current Plasma Emission Spectrometry
b. Flame Atomic Absorption Spectrometry
c. Flame Atomic Emission Spectrometry
d. Gravimetry
e. Instrumental Neutron Activation Analysis
f. Isotope Dilution Mass Spectrometry
g. X-ray Fluorescence Spectrometry

Table 2. Non-certified Values of Constituent Elements

Element	Content, $\mu g/g$	Element	Content, $\mu g/g$
Cerium[e]	(105)	Manganese[g]	(1730)
Cesium[e]	(9.6)	Phosphorus[a]	(750)
Cobalt[e]	(26)	Rubidium[e]	(190)
Europium[e]	(1.9)	Scandium[e]	(22.5)
Hafnium[e]	(4.6)	Thorium[e]	(14)
		Zinc[e]	(150)

Preparation

The brick clay for SRM 679 was donated to NBS by F.J. Flanagan and J.W. Hasterman of the United States Geological Survey, Reston, VA and P. Rath of Maryland Clay Products, Inc., Beltsville, MD. Approximately 220 kg of brick clay was collected from an inactive clay pit belonging to Maryland Clay Products, Inc., Beltsville, MD. The collected clay was air-dried and passed through a roller mill and ball milled in batches of 50 kg. The clay was then sieved such that 95% of the clay passed through a 200-mesh sieve. The clay was then mixed in a 0.3 cubic meter Vee blender for approximately 45 minutes. After blending the clay was placed in polyethylene lined aluminum pails and subsequently bottled.

Table 3. Multipliers for Element to Oxide Conversion

Constituent Element	Oxide Assumed*	Multiplier
Aluminum	Al_2O_3	1.88946
Barium	BaO	1.11650
Calcium	CaO	1.39919
Cerium	CeO_2	1.22838
Cesium	Cs_2O	1.06019
Chromium	Cr_2O_3	1.46155
Cobalt	CoO	1.27148
Europium	Eu_2O_3	1.15793
Hafnium	HfO_2	1.17929
Iron	Fe_2O_3	1.42974
Lithium	Li_2O	2.15283
Magnesium	MgO	1.65807
Manganese	MnO	1.29122
Phosphorus	P_2O_5	2.29137
Potassium	K_2O	1.20459
Rubidium	Rb_2O	1.09360
Scandium	Sc_2O_3	1.53384
Silicon	SiO_2	2.13931
Sodium	Na_2O	1.34798
Strontium	SrO	1.18261
Thorium	ThO_2	1.13790
Titanium	TiO_2	1.66806
Zinc	ZnO	1.24476

*Phase determinations of SRM 679 were not performed, therefore the multipliers will yield an "equivalent" oxide concentration for the oxide assumed. No certification of phases is intended or implied.