National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 1880

Portland Cement

(Cap Color is Black)

This Standard Reference Material (SRM) is intended for use in evaluating chemical methods of analysis and in the calibration of instrumental methods of analysis. SRM 1880 consists of three sealed vials of Type 1 Portland cement, each containing approximately 5 grams.

The certified value listed for a constituent is the present best estimate of the "true" value based on the results of a definitive analysis program carried out in the laboratories of the Portland Cement Association. The certified value for a constituent is not expected to deviate from the "true" value by more than $\pm$ 1 in the last significant figure reported; for a subscript figure, the deviation is not expected to be more than $\pm$ 5. Based on the results of homogeneity testing, maximum variations within and among samples are estimated to be less than those uncertainty figures.

Constituent	Percent by Weight	Constituent	Percent by Weight
CaO[a]	63.1_4	Na_2O	0.28
SiO_2	19.8_2	SrO	0.06
Al_2O_3	5.0_3	P_2O_5	0.29
Fe_2O_3	2.91	Mn_2O_3	0.08
SO_3	3.37	F	0.10
MgO[a]	2.6_9	Cl	0.02
K_2O	0.91	ZnO	0.01
TiO_2	0.23	Ign. loss	1.38
		Total[b]	100.28

[a]If the procedures of ASTM C114 are followed, a small amount of CaO will remain in the MgO precipitate. In this case the uncorrected values given below for CaO and MgO should be used:

CaO	63.0_5
MgO	2.7_5

[b]A correction has been made for the amount of fluoride present. This correction, which was subtracted from the gross total, was determined by multiplying the percent fluoride by the ratio of the atomic weight of oxygen to twice the atomic weight of fluorine (0.421). Correction of the total for the small amount of chloride was negligible (<0.01%).

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by R.K. Kirby. Revision of the 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 value or any technical data presented in this certificate.

Gaithersburg, MD 20899
January 22, 1993
(Revision of certificate dated 2-10-84)

William P. Reed, Chief
Standard Reference Materials Program

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Acknowledgements

The preparation of this material and the coordination of technical measurements leading to certification were performed under the direction of H.M. Kanare of the Chemical/Physical Research Department, Portland Cement Association (PCA), Skokie, Illinois. The cement was ground and blended with the aid of C. Wilk, J. Leonard, and H. Love. The packaging operations were performed by E. LaBonde, J. Leonard, M. McCann, C. Palmiano, and C. Wilk. Homogeneity testing was performed by C. Palmiano. The definitive analyses were conducted by R. Crow, E. LaBonde, and H. Seiler.

Preparations

This SRM was blended from equal parts of Type 1 Portland cement supplied by the St. Mary's Cement Company in Canada and the Texas Cement Company. Before blending, each cement was ground in an impact mill until all particles were between 0.5 and 45 μm as selected with an air classifier. The size distributions of the two cements, as determined with a sedimentation apparatus, were quite similar. Tests indicated that after 6 1/2 hours of blending the mix was homogeneous.

Homogeneity Testing

Following the packaging of the cement in hermetically sealed glass vials the homogeneity was determined by measuring 36 samples selected in a stratified random process. X-ray fluorescence analysis was used to determine the differences in calcium, sulfur, and iron by four replicate measurements on each briquette.

Definitive Analysis

"Wet" chemical gravimetric methods were used for the major constituents CaO, SiO_2, Al_2O_3, and MgO. (The methods were essentially those of ASTM C114 using a 0.5-g sample.) Fe_2O_3 was determined by dichromate titration and SO_3 by precipitation in an acid solution. Atomic absorption spectroscopy techniques were used for K_2O, Na_2O, SrO, Mn_2O_3, and ZnO. Colorimetric techniques were used to determine TiO_2 and P_2O_5. Fluoride was determined by an ion selective electrode method and chloride was determined by a potentiometric titration method. Loss on ignition was determined at 1000 °C. In each determination duplicate measurements were made on three to ten randomly selected samples. Through the use of various techniques (colorimetric, gravimetric, and AAS) the presence of the following trace elements were determined to be less than 0.01 wt.%: Ba, Zr, B, and Cr. The total of 100.28% of the certified constituents in the cement corroborates the evaluation and indicates that significant biases have not been introduced.

Caution

To obtain the most accurate results by x-ray fluorescence methods of analysis, the user should compare his samples to the particular SRMs that are most nearly the same in overall chemical composition. Alternatively, interelement effect calibration procedures may be adopted to minimize biases.