



Standard Practice for Measuring Hydration Kinetics of Hydraulic Cementitious Mixtures Using Isothermal Calorimetry¹

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1. Scope*

1.1 This practice describes the apparatus and procedure for measuring relative differences in hydration kinetics of hydraulic cementitious mixtures, either in paste or mortar (see **Note 1**), including those containing admixtures, various supplementary cementitious materials (SCM), and other fine materials by measuring the thermal power using an isothermal calorimeter.

NOTE 1—Paste specimens are often preferred for mechanistic research when details of individual reaction peaks are important or for particular calorimetry configurations. Mortar specimens may give results that have better correlation with concrete setting and early strength development and are often preferred to evaluate different mixture proportions for concrete. Both paste and mortar studies have been found to be effective in evaluating concrete field problems due to incompatibility of materials used in concrete mixtures.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.²)*

2. Referenced Documents

2.1 ASTM Standards:³

C125 Terminology Relating to Concrete and Concrete Aggregates

C172 Practice for Sampling Freshly Mixed Concrete

C219 Terminology Relating to Hydraulic Cement

¹ This practice is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.48 on Performance of Cementitious Materials and Admixture Combinations.

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² Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

C403/C403M Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

C778 Specification for Sand

C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

2.2 Other Standard:

API Specification RP 10B-2/ ISO 10426-2 Recommended Practice for Testing Well Cements⁴

3. Terminology

3.1 **Definitions**—For definitions of terms used in this practice, refer to Terminology **C125** and Terminology **C219**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 **baseline, *n***—the signal from the calorimeter when there is an inert specimen in the instrument.

3.2.2 **calcium aluminate, *n***—various aluminate phases including but not limited to the tricalcium aluminate and ferrite phases in portland cement clinker, calcium aluminate phases occurring in some supplementary cementitious materials, and calcium-alumino-silicate glasses also occurring in some supplementary cementitious materials, that are capable of consuming the sulfate phases present in hydrating cementitious systems.

3.2.3 **calibration coefficient, *n***—a factor that relates the value recorded by the data acquisition system to the thermal power output.

3.2.3.1 **Discussion**—Normally recorded data are in volts and the calibration coefficient has units of watts per volt (W/V). Some calorimeters may have internal automatic calibration and will give the output in watts without the user having to specify the calibration coefficient.

⁴ Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://api-ec.api.org>.

*A Summary of Changes section appears at the end of this standard