Calorimetry of Cement-Based Materials

The following bibliography of articles which relate to the calorimetry of cement-based materials has been compiled by ASTM Subcommittee C01.26 on Heat of Hydration. The bibliography has been subdivided based on the three major methods for determining heat of hydration: isothermal conduction calorimetry, adiabatic or semi-adiabatic calorimetry, and the heat of solution technique. Within these categories, the articles have been grouped into decades based on their publication date. This bibliographic data base is also available over the Internet at http://titan.cbt.nist.gov/. From the main homepage, the user simply clicks on Databases and then clicks on the Bibliographic Database on Calorimetry of Cementitious Materials. Anyone knowing of articles relating to this topic which are not included in this published list can e-mail the complete references to dale.bentz@nist.gov or fax them to Dale Bentz at (301) 990-6891, so that the electronic and hardcopy versions may be updated.

Isothermal Conduction Calorimetry

In this technique, the heat of hydration of cement is directly measured by monitoring the heat flow from the specimen when both the specimen and the surrounding environment are maintained at approximately isothermal conditions. Thermopiles are often used to convert the thermal flux into a voltage which can be continuously monitored. Thus, the cells are often calibrated electrically. Sensitivity limitations usually limit this measurement to about 7 days duration, as beyond this point, the signal becomes virtually indistinguishable from its background level. One difficulty lies in capturing the heat released during the initial mixing (wetting) of the cement and water. Calorimeters have been designed with internal mixing units to attempt to capture the complete heat signature curve.

1920–1929


1930–1939


1940–1949


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1950–1959


1960–1969


1980–1989


1990–1995


1990–1995


Adiabatic or Semi-Adiabatic Calorimetry

In this method, the specimen chamber is usually well-insulated in an attempt to attain adiabatic (no heat flow) conditions. The temperature rise of the specimen indicates the heat being produced during the hydration. To determine heat fluxes, the heat capacities of the specimen and system components must be determined separately. A semi-adiabatic method, commonly referred to as the Langavant method, is the basis of the French standard for determining the heat of hydration of cementitious materials.

1930–1939


1960–1969

1970–1979


1980–1989


1990–1995


Heat of Solution Technique

This technique, established as ASTM Test Method C 186 in 1944, consists of determining the heat of solution of hydrated cement by dissolving the hydrated material in a mixture of acids and recording the temperature rise in an insulated container. By subtracting the equivalent measure for the unhydrated cement powder, the heat of hydration can be obtained. Typically, zinc oxide (ZnO) is used as a reference material for calibration of the heat capacities of the experimental setup, and so forth. Measurements are typically performed after 7 and 28 days of hydration.

1930–1939


1940–1949


1950–1959


1960–1969


1970–1979


1980–1989


1990–1995


Acknowledgments

As Chairman of Subcommittee C01.26 on Heat of Hydration, I would like to gratefully acknowledge the efforts and contributions from the following people who made it possible for this bibliography to be published:

- Cynthia Spigelman and the PCA Library Service Group
- Dale Bentz (NIST)

The objective of this on-going project has been to compile a comprehensive bibliography of published papers pertaining to cement heat of hydration methods developed and used during the last 75 years. We believe that the first step has now been taken towards making available such a reference. Subcommittee C01.26 plans to submit an updated revision to this bibliography, perhaps every three years, as new papers on the calorimetry of cement are published.

L. D. Adams, Subcommittee C01.26 Chairman

Portland Cement Data Bases Available on the Internet

The data base compiled for ASTM Committee C-1 on Cement by Ronald Gebhardt in the 1994 survey of North American portland cements (see the December 1994 issue of Cement, Concrete, and Aggregates) is now available for remote access over the Internet. In addition, a portion of the data base from the long-term study conducted at the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards) in the 1950s (see NBS Building Science Series BSS 2 and BSS 36), converted to electronic format by the Portland Cement Association, is also available. New data bases will be added in the future as they become available.

The Uniform Resource Locator (URL) to access the cements data bases is http://ciks.cbt.nist.gov/cements/. The user may login using the username “cements” and the password “hydration” by clicking on the Connect button and then select the data base of interest (astm94_cements or nbs53_cements). Once a data table is selected, the user is presented with a table in which they may select one or more columns of the data to be retrieved, specifying a single optional constraint (for example, C3S contents greater than 60%). All requested columns for all data meeting the constraint will be returned to the user. Finally, the user may select to plot one or more response data variables against a single dependent variable (for example, plotting 3-day compressive strength versus C3A content). A program is executed over the Internet to create the plot and return the graphical output to the user’s Internet browser. Portions of the data bases or the graphical output can then be printed using the built-in capabilities of most WWW browsers. Any questions on the cements data bases available from NIST over the Internet may be addressed to Dale Bentz at NIST by phoning (301) 975-5865 or e-mailing dale.bentz@nist.gov.
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Additional Information for Authors

The Cement, Concrete, and Aggregates (CCA) Journal is a biannual publication sponsored by ASTM technical committee C-1 on Cement and C-9 on Concrete and Concrete Aggregates, with support from C-13 on Concrete Pipe and C-27 on Precast Concrete Products. Each published paper and technical note has been peer-reviewed. Papers and technical notes are open to brief written comments in the Discussion section of the Journal, which also includes authors' written responses.

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Editor-in-Chief

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