

Methods of testing cement - Part 8: Heat of hydration - Solution method

Methods of testing cement - Part 8: Heat of hydration - Solution method

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 196-8:2004 sisaldab Euroopa standardi EN 196-8:2003 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 28.01.2004 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 196-8:2004 consists of the English text of the European standard EN 196-8:2003.</p> <p>This document is endorsed on 28.01.2004 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

<p>Käsitlusala:</p> <p>This European Standard describes a method of determining the heat of hydration of cements by means of solution calorimetry, also known as the solution method. The heat of hydration is expressed in joules per gram of cement.</p>	<p>Scope:</p> <p>This European Standard describes a method of determining the heat of hydration of cements by means of solution calorimetry, also known as the solution method. The heat of hydration is expressed in joules per gram of cement.</p>
---	---

ICS 91.100.10

Võtmesõnad:

ICS 91.100.10

English version

Methods of testing cement - Part 8: Heat of hydration - Solution method

Méthodes d'essai des ciments - Partie 8: Chaleur d'hydratation - Méthode par dissolution

Prüfverfahren für Zement - Teil 8: Hydratationswärme - Lösungsverfahren

This European Standard was approved by CEN on 25 March 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword	3
1 Scope	4
2 Normative references	4
3 Principle	4
4 Materials	4
4.1 Acid mixture	4
4.2 Zinc oxide (ZnO)	5
4.3 Anhydrous cement	5
4.4 Hydrated cement	5
5 Apparatus	5
5.1 Calorimeter	5
6 Calorimeter calibration	7
6.1 Principle	7
6.2 Procedure	7
6.3 Calculation of calibration characteristics	8
6.3.1 Corrected temperature increase, ΔT_c	8
6.3.2 Thermal leakage coefficient, K	8
6.3.3 Thermal capacity, C	8
7 Determination of heat of solution	9
7.1 Heat of solution of anhydrous cement	9
7.1.1 Procedure	9
7.1.2 Calculation	10
7.1.3 Expression of results	11
7.2 Heat of solution of hydrated cement	11
7.2.1 Procedure	11
7.2.2 Correction for bound water	11
7.2.3 Calculation	12
7.2.4 Expression of results	13
8 Heat of hydration	13
8.1 Calculation of results	13
8.2 Reporting of results	13
8.3 Precision	13
8.3.1 Repeatability	13
8.3.2 Reproducibility	13
Bibliography	14

Foreword

This document (EN 196-8:2003) has been prepared by Technical Committee CEN/TC 51, 'Cement and building limes', the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

This European Standard on the methods of testing cement comprises the following Parts:

EN 196-1 *Methods of testing cement — Part 1: Determination of strength*

EN 196-2 *Methods of testing cement — Part 2: Chemical analysis of cement*

EN 196-3 *Methods of testing cement — Part 3: Determination of setting time and soundness*

EN 196-5 *Methods of testing cement — Part 5: Pozzolanicity test for pozzolanic cements*

EN 196-6 *Methods of testing cement — Part 6: Determination of fineness*

EN 196-7 *Methods of testing cement — Part 7: Methods of taking and preparing samples of cement*

EN 196-8: *Methods of testing cement — Part 8: Heat of hydration - solution method*

EN 196-9: *Methods of testing cement — Part 9: Heat of hydration — semi-adiabatic method*

EN 196-21: *Methods of testing cement — Part 21: Determination of the chloride, carbon dioxide and alkali content of cement*

EN 196-21 is currently being revised and incorporated into EN 196-2.

Another document, ENV 196-4 *Methods of testing cement — Part 4: Quantitative determination of constituents*, has been drafted and will be published as a CEN Technical Report.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard describes a method of determining the heat of hydration of cements by means of solution calorimetry, also known as the solution method. The heat of hydration is expressed in joules per gram of cement.

This standard is applicable to cements and hydraulic binders whatever their chemical composition.

NOTE 1 Another procedure, called the semi-adiabatic method, is described in EN 196-9. Either procedure can be used independently.

NOTE 2 It has been demonstrated that the best correlation between the two methods is obtained at 7 days for the solution method (EN 196-8) compared with 41 h for the semi-adiabatic method (EN 196-9).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 197-1, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*.

3 Principle

The method consists in measuring the heats of solution, in an acid mixture, of anhydrous cement and cement hydrated under standardized conditions for a predetermined period of time, e.g. 7 days.

These standardized hydration conditions are as follows:

- water/cement ratio 0,40;
- use of neat cement paste;
- storage at constant temperature of $(20,0 \pm 0,2) ^\circ\text{C}$ during the whole hydration process.

The heat of hydration for each period, H_i , is obtained from the difference between the heat of solution of anhydrous cement, Q_a , and that of hydrated cement, Q_i .

4 Materials

4.1 Acid mixture

Analytical reagent quality acid mixture, obtained by adding 2,760 g of 40 % hydrofluoric acid (HF) for every 100,0 g of $(2,00 \pm 0,01)$ mol/l nitric acid (HNO_3), or 2,600 ml of hydrofluoric acid for every 100,0 ml of nitric acid.

WARNING Hydrofluoric acid can cause painful skin burns which heal only with difficulty and precautions in handling this very corrosive substance should be strictly observed.