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Petrography of Cementitious Materials

DeHayes/Stark, editors



STP 1215

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Sharon M. DeHayes and David Stark, Editors

ASTM Publication Code Number (PCN):
04-012150-07



ASTM
1916 Race Street
Philadelphia, PA 19103
Printed in the U.S.A.

Library of Congress Cataloging-in-Publication Data

Petrography of cementitious materials / Sharon M. DeHayes and David Stark, editors.

(STP ; 1215)

"Contains papers presented at the Symposium on the Petrography of Cementitious Materials, held in Atlanta, GA on 23 June 1993"--Galley.

Includes bibliographical references.

ISBN 0-8031-1878-3

1. Cement--Congresses. 2. Concrete--Congresses. 3. Petrology--Congresses. I. DeHayes, Sharon M., 1953-. II. Stark, D. (David) III. Symposium on the Petrography of Cementitious Materials (1993 : Atlanta, Ga.) IV. Series: ASTM special technical publication ; 1215.

TA434.P44 1994

620.1'35--dc20

94-11867

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Peer Review Policy

Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

To make technical information available as quickly as possible, the peer-reviewed papers in this publication were printed "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

Printed in Philadelphia, PA
May 1994

Foreword

This publication, *Petrography in Cementitious Materials*, contains papers presented at the symposium of the same name, held in Atlanta, GA on 23 June 1993. The symposium was sponsored by ASTM Committee C-9 on Concrete and Concrete Aggregates and ASTM Committee C-1 on Cement. Sharon M. DeHayes of the California Portland Cement Company in Glendora, CA and David Stark of Construction Technology Laboratories in Skokie, IL presided as symposium chairpeople and are editors of the resulting publication.

Contents

Overview	vii
Petrographic Methods for Analysis of Cement Clinker and Concrete Microstructure—W. U. AHMED	1
A Summary of Ono's Method for Cement Quality Control with Emphasis on Belite Color—D. H. CAMPBELL	13
The Microstructural Approach to Solving Clinker-Related Problems—S. L. SARKAR AND B. SAMET	26
Progress Toward a Standard Procedure for Point-Counting the Phases in Cement Clinker with Reflected Light Microscopy—W. A. WEIGAND	51
SEM Analysis and Computer Modelling of Hydration of Portland Cement Particles—D. P. BENTZ AND P. E. STUTZMAN	60
Applications of Scanning Electron Microscopy in Cement and Concrete Petrography—P. E. STUTZMAN	74
The Influence of Cement Type and Degree of Hydration on the Measurement of W/C Ratio on Concrete Fluorescent Thin Sections—S. WIRGOT AND F. VAN CAUWELAERT	91
The Identification and Measurement of Entrained Air in Concrete Using Image Analysis—J. CAHILL, J. C. DOLAN, AND P. W. INWARD	111
Petrographic Examination of Reinforced Concrete from Cathodically Protected Structures—D. R. LANKARD, N. J. SCAGLIONE, AND J. E. BENNETT	125

Overview

On 23 June, 1993, ASTM Committees C-1 on Cement and C-9 on Concrete and Concrete Aggregates, cosponsored a symposium on the Petrography of Cementitious Materials. Papers in this symposium focused primarily on cementitious materials in portland cement concrete as characterized by optical and electron microscopy and by other analytical techniques. The intent of this symposium was to complement a previous symposium (STP 1061) held on 26 June, 1989 at the ASTM meeting in St. Louis, MO entitled Petrography Applied to Concrete and Concrete Aggregates. It was hoped the two symposia together would demonstrate the wide ranging potential of petrography as a tool in forensic, as well as in fundamental investigations of cement and concrete properties and performance.

An underlying theme in the present symposia papers is the description of techniques used to characterize the properties of cementitious materials and hardened concrete. The paper by Ahmed describes techniques and the need for obtaining high quality surfaces for optical microscopical observation of cement clinker and concrete. Without quality surfaces, observations and conclusions are limited and can be misleading. Campbell describes the use of a transmitted light technique, commonly referred to as the Ono Method, for characterizing phase composition, specifically belite, as it relates to quality control in the production of portland-cement clinker. The advantage of combining optical microscopy with scanning electron microscopy and energy dispersive X-ray analysis to characterize clinker production is demonstrated in the paper by Sarkar and Samet. The paper by Weigand reports results of inter- and intra-laboratory studies using optical microscopy to determine phase composition of portland-cement clinker. This study was sponsored by ASTM Committee C01.23 on Compositional Analysis.

Bentz and Stutzman, and Stutzman, report on the use of computer modeling and scanning electron microscopy to determine and describe the phase composition and microstructure of clinker and portland cement. The use of these techniques in developing a two-dimensional model of cement-hydration processes is described in one of the papers.

Three papers in the symposium focus on characteristics of hydrated cement paste as they may affect the performance of concrete. The Wirgot and Van Cauwelaert paper deals with determining the water-cement ratio of concrete using a fluorescent epoxy resin as the adhesive for petrographic thin sections. Image analysis and statistical analyses are used to obtain final results. The paper by Cahill et al. describes the use of image analysis to determine the entrained air content of hardened concrete. The Lankard et al. paper describes the alteration of concrete located adjacent to electrode/concrete interfaces in structures that have been under cathodic protection.

All of the papers in this symposium are timely in their technical content and should familiarize the reader with recent developments, primarily in the application of microscopic analytical techniques to concrete performance. It also is hoped that these symposia papers, together with those in the previous symposium held in 1989, will lead to the wider use of petrographic techniques in maintaining quality control of concrete products and to clearer resolution of durability problems encountered in the field.

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ISBN 0-8031-1878-3