

**PROCEEDINGS
OF THE
TENTH INTERNATIONAL CONFERENCE
ON
CEMENT MICROSCOPY**

*International
Cement
Microscopy
Association*



**April 11-14, 1988
San Antonio, Texas
U.S.A.**

**INTERNATIONAL CEMENT MICROSCOPY ASSOCIATION
1206 COVENTRY LANE, DUNCANVILLE
TEXAS, 75137, U.S.A.**

**PROCEEDINGS OF THE
TENTH INTERNATIONAL CONFERENCE
ON CEMENT MICROSCOPY**

**EDITED BY:
GEORGE R. GOUDA
ARTURO NISPEROS
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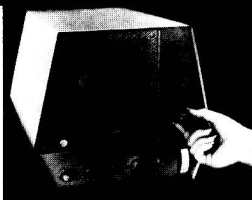
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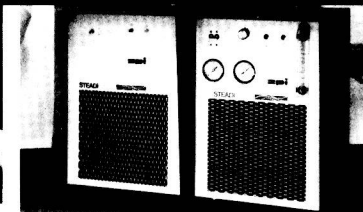
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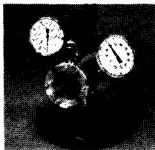
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FOREWARD

ICMA actually started in October of 1978 when Ken Earhart, Vice President of the Gifford-Hill Cement Company, suggested that a gathering of cement microscopists for the mutual exchange of ideas and technical data would be a good idea. A meeting was proposed and held in Arlington, Texas, with approximately 45 people in attendance. The primary speaker for this meeting was Don Campbell of P.C.A. John Marlin of O.K.C. also gave a demonstration of staining and etching techniques. The whole tone of the meeting was kept very informal and application techniques were stressed as our focal point.

In March of 1980, a second meeting was held. Gifford-Hill was joined this time by Southwestern and General Portland as sponsoring companies. Approximately 175 people attended the meeting held in Dallas, Texas. The meeting highlight was an address to the attendees by Dr. Yoshio Ono. Application techniques were also stressed at this meeting and a small workshop and exhibition of equipment was held in conjunction with the meeting. There were no proceedings published for the first and second meetings.

The actual formation of ICMA occurred at the third meeting (1981). At this meeting, we gave up our company sponsorship and went independent. Following 1980, ICMA met annually as follows:

- The Third Annual Meeting - March 16-19, 1981, Houston, Texas
- The Fourth Annual Meeting - March 28-April 1, 1982, Las Vegas, Nevada
- The Fifth Annual Meeting - March 14-17, 1983, Nashville, Tennessee
- The Sixth Annual Meeting - March 26-29, 1984, Albuquerque, New Mexico
- The Seventh Annual Meeting - March 25-28, 1985, Fort Worth, Texas
- The Eighth Annual Meeting - April 6-10, 1986, Orlando, Florida
- The Ninth Annual Meeting - April 5-9, 1987, Reno, Nevada
- The Tenth Annual Meeting - April 11-14, 1988, San Antonio, Texas
- The next, Eleventh Annual Meeting is scheduled for April, 1989 in New Orleans, Louisiana, USA

The proceedings of each meeting, containing all the papers; is published annually.

INTRODUCTORY REMARKS

These are the Proceedings of the Tenth International Conference on Cement Microscopy On April 10-14, 1988 in San Antonio, Texas, U.S.A.

These papers represent the latest development of clinker, cement and concrete microscopic technique. Efforts are continuously develop the appropriate application of "Cement Microscopy" know-how as these are the major concern to assure the clinker, cement and concrete qualities. By applying the clinker microscopy, the cement manufacturing process can be optimized to produce a clinker of a competitive quality at the lowest possible cost.

This proceedings, as well as the previous ones offer a comprehensive reference and best authoritative available picture of know-how and experience in "Cement Microscopy", gathered from the different experts in this field from all over the world. It is meant to serve as a working tool, a source of reference and a problem solving for clinker, cement and concrete production.

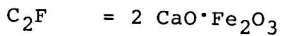
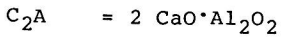
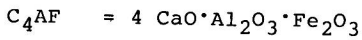
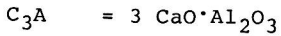
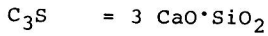
I wish to express my gratitude to the authors for their contributions and their sincere spirit which made this Conference and the post conferences possible.

On behalf of the ICMA Committee, I welcome all the attendees of the 1988 Conference, wishing them a happy stay and enjoyable time in San Antonio, Texas.

George Gouda

NOTES

The following abbreviated formula are used in these proceedings:



S.M. = Silica Modulus

A.M. = Alumina Modulus

H.M. = Hydraulic Modulus

L.S.F. = Lime Saturation Factor



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TABLE OF CONTENTS

Committee of The International Cement Microscopy Assoc.	ii
A Word of Thanks	iii
Foreward	iv
Introductory Remarks	v
Notes	vi
List of 1988 Papers	vii
Instructions for Manuscript Preparation - ICMA Proceedings	425
Call For Papers - Eleventh International Conference of Cement Microscopy, April 10-13, 1989	429

LIST OF 1988 PAPERS

Abnormal Flames and Their Influence on Cement Kiln Process and Quality - A Case History	1
David Norris; Lafarge Corporation, New Braunfels, Texas, U.S.A.	
A Study of The Effect of Microstructures and Other Physical Properties of Slags on Their Hydraulic Activity	17
G. Goswami and J.D. Panda; Dalmia Institute of Scientific and Industrial Research, Rajgangpur, India	
Clinker Phase Identification By Automated x-Ray Diffractometry - An Evaluation	30
Shondeep L. Sarkar, University de Sherbrooke, Quebec, Canada	
Morphology and Microstructure of Clinker Samples Produced by CRI-MVSK Mini Cement Plants	42
K. Raina, S. Chatterjee and D. B. Irani; National Council for Cement and Building Materials, New Delhi, India	
Microscopical Investigation on the Pozzolan Behavior of Fly Ashes	58
N. Tenoutasse, REDCO, Belgium and A. M. Marion; University of Brussels, Belgium	
Investigations on Microstructural Behavior and Performance of Non-Portland Binders.	71
K. C. Narang; Dalmia Cement (Bharat) Ltd., New Delhi, India	

Direct Measure of Spacing Factor in Air Entrained Concrete	82
W. F. Buckingham; Everest Technologies Inc. and J. M. Spaw; Everest Geotech Company, Houston, Texas, U.S.A.	
Kiln Feed Homogeneity and Clinker Microcopy	93
David Norris; Lafarge Corporation, New Braunfels, Texas, U.S.A.	
Phase Segregation in Portland Cement During Grinding	99
Shondeep L. Sarkar and Pierre-Claude Aitcin; University de Sherbrooke, Quebec, Canada	
Rice Husk Ash Cement	115
J. James; National Council for Cement and Building Materials, New Delhi, India and M. Subba Rao; Indian Institute of Science, Bangalore, India	
Characterization and Properties of the New Calcium- Silicate-Hydrates	131
(C-S-H (III) and C-S-H (II ²))	
F. Hannawayya; F. H.'s Laboratory for Chemical Research and Development, Stockholm, Sweden	
The Effect of Crystallinity of Limestone and Particle Size Distribution of Kiln Feed on the Dust Emission, Specific Power Consumption and Clinker Output - A Case Study	151
D. B. N. Rao; Andhra Cement Company, Secunderabad, Andra Pradesh, India	
Panel on Specialty Cements - Remarks	177
Tom Rader; Southwestern Portland Cement Company, California, U.S.A.	

Problem in Cement Strength Decrease and Its Solution Using Microscopy	178
Cesar Arbelaez; C. A. Venezolana de Cementos Pertigalete, Venezuela	
Ono Evaluation of a Cement Clinker Produced Using By-Product Phosphogypsum as a Source of CaO	202
P du Toit; Division of Building Technology, CSIR, Pretoria, South Africa	
Microscopical Investigations of Some Historic Mortars	212
D. F. E. Knofel and S. G. Wisser; University Siegen, Siegen, West Germany	
SEM Coupled with EDAX: A Convenient Technique For The Diagnosis of Chemical Pathology in Cement-Based Material	223
N. Tenoutasse; REDCO, Belgium and A. M. Marion; University of Brussels, Belgium	
The Use of Microscopy and x-Ray Diffraction Analysis in The Study of A Case of Concrete Cracking	237
Arnaldo F. Battagin; Brazilian Association of Portland Cement, Sao Paulo, Brazil	
The Effect of Fly Ash On the Sulphate Resistance of Concrete	250
P. J. Tikalsky and R. L. Carrasquillo; University of Texas at Austin, Austin, Texas, U.S.A.	
Microstructure and Durability of Limestones	265
Stella L. Marusin; Wiss, Janney, Elastner Associates, Inc., Northbrook, Illinois, U.S.A.	

Industrial Applications of Quantitative Study of Portland Cement Clinker through Reflected Light Microscopy	277
B. Cariau, R. Ranc, F. Sorrentino; Lafarge Copee Recherche, Viviers, France	
QXRD in Cement and Clinker Phase Analysis: Its Progress and Limitations	285
S. L. Sarkar; University de Sherbrooke, Quebec, Canada, and D. M. Roy; The Pennsylvania State University, Pa., U.S.A.	
Preliminary Results on a Petrographical Examination of Alkali-Silica Reaction Damage in Belgium	298
E. Soers; GEOS, Wallen, Belgium	
Aspects of Cement Performance in Concrete As Revealed by Clinker Microscopy	306
F. M. Miller and R. L. Venable; Ideal Basic Industries, Tijeras, New Mexico, U.S.A.	
Effect of Organic Additives on The Hydration Behavior of the Aluminate Phase of Cement	324
Herbert Poellmann; Minerological Institute Erlangen, Federal Republic of Germany	
Identifying Fly Ash, Slag and Silica Fume in Blended Cements and Hardened Concrete	344
George Papadopoulos and Bruce Suprenant; University of South Florida, Tampa, Florida, U.S.A.	
Optical Instrumentation For Cement Microscopy	357
Frank E. Fryer; F. E. Fryer Company, Carpentersville, Illinois, U.S.A.	
Seawater Hydration of Early 20th Century Cement, Biscayne Bay Shipwreck, Florida, U.S.A.	361
D. H. Campbell; Construction Technology Laboratories, Inc., Skokie, Illinois, U.S.A.	

Retrographic Identification of A High-Range Water- Reducing Admixture in Hardened Concrete	373
J. L. Randolph; Neyer, Tiseo & Hindo, Ltd., Farmington Hills, Michigan, U.S.A.	
Penndot Experiences in Cement Microscopy	389
D. R. Reidenouer; Pennsylvania Department of Transportation, Harrisburg, Pennsylvania, U.S.A.	
Clinker Microstructure Differences between Two Identical Kilns - A Comparative Study	408
L. A. Jany & M. A. Renninck; Allentown Cement Company, Inc., Blandon, Pennsylvania, U.S.A.	
Examples of Inhomogeneities in Cement Paste in Concrete	414
A. D. Jensen, S. Chatterji and I. Brandt; Teknologisk Institut, Taastrup, Denmark	
Oil Well Cement Panel Discussions: Factors Which Influence the Performance of a Cement	420
W. A. Weigand; W. R. Grace & Co., Cambridge, Mass., U.S.A.	
Communications are Vital or How to Sink in a Cement Canoe	422
Nancy K. Reeves; Halliburton Services, Evansville, Wyoming, U.S.A.	
Sample Exchange Program -	423
W. W. Rowe; Texas Industries Inc., Midlothian, Texas, U.S.A.	
Instructions For Manuscript Preparation for ICMA Proceedings	425
Call For Papers - Eleventh International Conference of Cement Microscopy, April 10-13, 1989	429

ABNORMAL FLAMES AND THEIR INFLUENCE
ON CEMENT KILN PROCESS AND QUALITY -
A CASE HISTORY

David Norris
Q.C. Manager, Balcones Plant
LaFarge Corporation

ABSTRACT

The importance of the flame in a cement kiln cannot be overrated. The Balcones Plant of LaFarge Corporation has been attempting to provide itself with a burner pipe that provides the best possible flame and flame control. Plant trials of a new design burner pipe were conducted in late 1986 and 1987. Experiences and data collected during this period are presented in this article. The conclusions support present industry knowledge.

None of the flames improved the burning zone appearance significantly, the clinker granulometry, nor the cement performance. Significant differences in the performance of class H cement were attributed to the divergent reducing flames. A relationship between primary air velocity and NO_x was noted. A relationship between clinker K₂O and 7-28 day mortar strengths was also noted. The influence of the flame on kiln stability was proven.

INTRODUCTION

The study of flames in cement kilns involves many complex factors, some still unknown. Empirical control and operation of kilns has long been the "art" of good cement manufacturing. The advent of shell scanners, gas analyzers, microscopy, pyrometers, and other modern "eyes" into the flame have indeed helped in this endeavor. The data gathered by this case study used some of these modern techniques, but still fully supports the classic kiln operator's guidelines of stability, coating, flame appearance, clinker appearance, and cement performance.

The kiln at the Balcones Plant of General Portland (LaFarge) had been running since 1981 using a burner pipe designed by General Portland personnel. The flame produced by this pipe proved to be quite good for the plant given the demands on production in that period. The need to increase kiln production and the fact that the flame produced was too susceptible to lengthening as the excess air needed for precalcination or bypass was increased, forced the search for a better pipe. A more cohesive flame was needed. Thus began the ten month Odyssey that is summarized by this article.

DESCRIPTION OF KILN SYSTEM

The kiln at Balcones is a Polysius Dopol four stage AT precalciner. It is 4.6 meters (15 feet 1 inch) in diameter and 73.8 meters (242 feet) long. Rated production of the kiln is 2500 metric tons (2750 short tons) per day. Desired production of the kiln is 2720+ tons (3000+ short tons) per day. The kiln is fired by an indirect system with coal/coke mixture. The precalciner uses about 20% of the total KCAL's (BTU's), (which are injected into the riser duct). Excess volatiles are removed via a bypass system with a takeoff located just inside the tower from the kiln inlet. The clinker is cooled by an eight compartment, two drive Fuller grate cooler. A gravel bed filter cleans the cooler exhaust air before it is discharged.

THE PROBLEM

The changes in the Texas cement market in 1986-87 resulted in the need to increase production capabilities at the Balcones Plant. Plant personnel, with assistance from corporate engineering, determined the necessary equipment upgrades needed to accomplish this goal. One of those recommendations was to obtain a burner pipe that produced a more cohesive flame than the one being used.