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
JAMES BAYLES

SPONSORED AND ORGANIZED BY:
INTERNATIONAL CEMENT MICROSCOPY ASSOCIATION
1206 COVENTRY LANE, DUNCANVILLE
TEXAS, 75137, USA

LA MANSION DEL RIO HOTEL
SAN ANTONIO, TEXAS, USA
APRIL 11-14, 1988

COMMITTEE OF
THE INTERNATIONAL CEMENT MICROSCOPY ASSOCIATION
1206 COVENTRY LANE, DUNCANVILLE
TEXAS, 75137, U.S.A.

Walter W. Rowe General Chairman	Texas Industries, Inc. 245 Ward Road Midlothian, Texas 76065 U.S.A. (214) 299-5373
William R. Carruthers Site-Coordinator	Lafarge Corporation P.O. Box 324 Dallas, Texas 75221 U.S.A. (214) 934-7309
George R. Gouda Program Chairman	International Finance Corporation 1818 H Street, N.W. Washington, D.C. 20433 U.S.A. (202) 676-0560
Arturo G. Nisperos Program Chairman	Material Service Corporation 901 N. Sangamon Street Chicago, Illinois 60622 U.S.A. (312) 837-6725
James Bayles Program Chairman	Coplay Cement Company P.O. Box 32 Nazareth, Pennsylvania 18064 U.S.A. (215) 837-6725
Donald H. Campbell Workshop-Coordinator	Construction Technology Laboratories, Inc. 5420 Old Orchard Road Skokie, Illinois 60077-4321 U.S.A. (312) 965-7500
Charles Buchanan Publicity Chairman	Roan Industries, Inc. 7278 Park Drive Bath, Pennsylvania 18014 U.S.A. (215) 837-7707
Stella L. Marusin Exhibit-Coordinator	Wiss, Janney, Elstner 330 Pfingsten Road Northbrook, Illinois 60062 U.S.A. (312) 272-7400
Larry K. Roberts Communications-Coordinator	WR Grace & Co. 62 Whittemore Avenue Cambridge, Massachusetts 02140 U.S.A. (617) 876-1400

A WORD OF
THANKS

TO OUR CORPORATIONS AND COMPANIES

FROM THE ENTIRE COMMITTEE OF THE
INTERNATIONAL CEMENT MICROSCOPY ASSOCIATION

Texas Industries, Inc., USA

Lafarge Corporation, USA

International Finance Corporation, USA

Material Service Corporation, USA

Coplay Cement Company, USA

Construction Technology Laboratories, Inc., USA

Roan Industries, Inc., USA

Wiss, Janney, Elstner Associates, USA

W. R. Grace, USA

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 roceedings:

$S = SiO_2$ $A = Al_2O_3$ $F = Fe_2O_3$ $C = CaO$

C_3S = 3 $CaO \cdot SiO_2$

C_2S = 2 $CaO \cdot SiO_2$

C_3A = 3 $CaO \cdot Al_2O_3$

C_4AF = 4 $CaO \cdot Al_2O_3 \cdot Fe_2O_3$

C_2A = 2 $CaO \cdot Al_2O_2$

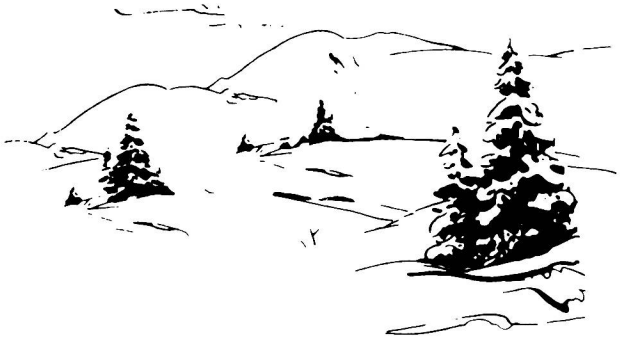
C_2F = 2 $CaO \cdot Fe_2O_3$

S.M. = Silica Modulus

A.M. = Alumina Modulus

H.M. = Hydraulic Modulus

L.S.F. = Lime Saturation Factor



ROAN INDUSTRIES, INC.

Corporate Office
439 Bolmar Street
West Chester, PA 19380
215-696-9220

Laboratory
7278 Park Drive
Bath, PA 18014
215-837-7707

PORTLAND CEMENT GRINDING AIDS
RII-77 • RI-85 • RI-77AA

CONSULTING
All aspects of finish and raw grinding circuits

CONSULTING
Environmental • Waste Solvent Burning

ANALYTICAL TESTING
Particle Size Analysis • PCB Analysis
Mass Spec Solvent Scans • Atomic Adsorption
Differential Thermal Analysis • Parr Calorimeter Energy Value
Air Content Hardened Concrete

ASTM
Laboratory Number 0701

CERTIFIED QUALITY CONTROL ENGINEER
Certificate Number 3072

TABLE OF CONTENTS

LIST OF 1988 PAPERS

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 NOx was noted. A relationship between clinker K20 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.