Ain Shams University
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Chemistry Department

Kinetics and Mechanism of Hydration between Active Silica and Lime-bearing Products

A Thesis
Submitted in Partial Fulfillment for the Requirements of the Degree of Master of Science in Chemistry

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Cairo - 2010

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ACKNOWLEDGEMENT

Praise and thanks be to **ALLAH** for giving me the opportunity and the strength to accomplish this work.

I wish to express my deepest gratitude to **Prof. Dr. Salah A. Abo El- Enein,** professor of Physical Chemistry and Building Materials, Faculty of Science, Ain Shams University and **Prof. Dr. Mohammed F. El-Shahat,** professor of Inorganic Chemistry, Faculty of Science, Ain Shams University**,** for planning the work, keen, supervision, with valuable guidance and discussion during the course of this investigation.

Abstract

The short- and long- term mechanical properties of high-performance concrete could be improved by the incorporation of different levels of rice-husk-ash (RHA) or silica fume (SF). The improvement was based on the pozzolanic interaction of RHA with the free calcium hydroxide liberated from Portland cement hydration leading to the formation of additional amounts calcium silicate hydrates (CSH) which have a strong hydraulic (strength-producing) character. Therefore, the main characteristics of hydration interaction between lime-rich sludge (LRS) and rice-husk-ash (RHA) were investigated in this study. Three LRS/RHA mixes (I, II and III) were used, having CaO/SiO_2 molar ratios of 1.0, 1.3 and 1.5.

The results obtained indicated that the main hydration products during the early and intermediate stages are lime- rich CSH; these hydrates undergo transformation into low- lime hydrates in mixes I & II which have relatively low CaO/SiO_2 molar ratios (1&1.3). While in mix III, which has a higher CaO/SiO_2 molar ratio (1.5), the lime-rich CSH represent the main hydration products at all ages of hydration up to28 days. It was found that the hydration mechanism between RHA and LRS consists of three main stages; these are: pre-dormant stage, dormant stage and acceleration stage.

LIST OF APPREVIATIONS

(LRS): Lime Rich Sludge

(RHA): Rice Husk Ash

(FA): Fly Ash

(SF): Silica Fume

(C-S-H): Calcium Silicate Hydrate

(OPC): Ordinary Portland Cement

(DSC): Differential Scanning Calorimetry

(XRD): X-Ray Diffraction

(HPC): High Performance Concrete

(BFS): Blast Furnace Slag

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