

Kinetics of the Reaction Between Fly Ash and Ca(OH)₂

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The kinetics of the alkali activated reaction between a Class F coal fly ash and Ca(OH)₂ were investigated using synchrotron x-ray diffraction. The synchrotron method provides several benefits over traditional methods such as conventional copper x-ray diffraction and thermal analysis techniques. *In situ* investigation of a single sample over a long period of time is possible thereby decreasing the possibility of side reactions including carbonation of Ca(OH)₂ due to exposure to air. By using synchrotron radiation small amounts of crystalline material in an amorphous environment can be detected. The use of capillary diffraction techniques also provides a bulk analysis and reduces the risk of surface effects, which can appear when preparing wet sample for conventional analysis.

Samples were prepared by mixing known amount of fly ash, Ca(OH)₂ and an inert standard (rutile) with .2 molar NaOH solution. The liquid to solids ratio was held constant for all samples. Ca(OH)₂/ash weight ratios of 12.5/87.5, 25/75, 50/50, 75/25 were used. Mixed samples were placed in capillary diffraction tubes and the tubes placed in water bathes. Temperatures of 25°, 40°, 50°, and 60° were investigated. Samples were analyzed periodically over a period of 80 days using 15keV radiation from 8-28° 2-θ .

Ca(OH)₂ consumption was determined quantitatively by calibration against the inert rutile standard. Initial calibration data shows very good linearity. This data will be used to estimate activation energy and propose a kinetic model and for the reaction. The data will then be used to update existing computer models that simulate this reaction and the similar reactions that occur when fly ash is added to Portland cement.

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