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HYDRATION MECHANISM OF TRICALCIUM ALUMINATE WITH LIME AT 1:1 MOLE RATIO AT LOW WATER/SOLID RATIO AND IN SUSPENSION

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ABSTRACT

The hydration mechanism of tricalcium aluminate C_3A with CaO at 1:1 mole ratio was studied in paste as well as slurry from 5 min up to 7 days of hydration. These studies were made with the aid of X-ray diffractometry, differential thermal analysis and thermogravimetric analysis. The results illustrate that the hydrate phases C_4AH_{13} and C_3AH_6 are still formed in the paste and slurry hydrations from 5 min up to 7 days. It was concluded that the free $Ca(OH)_2$ is also found in the two hydrated systems after 7 days. The amount of C_3AH_6 is maximum at 24 h and then decreases, whereas the amount of C_4AH_{13} increases with curing time.

INTRODUCTION

The quaternary system comprising CaO , Al_2O_3 , SiO_2 and Fe_2O_3 as well as H_2O are of importance in studying the chemistry and morphology of hydrous calcium silicates and aluminates in hydrating cement. Portland cement is composed of four major phases: tricalcium silicate C_3S , B-dicalcium silicate $B-C_2S$, tricalcium aluminate C_3A , and tetracalcium aluminoferrite C_4AF . C_3S and $B-C_2S$ liberate $Ca(OH)_2$ during the hydration of portland cement. It has been pointed out by some workers, such as Forsen [1], Seligman and Creening [2], Mori [3], Stein [4] and Copeland and Kantro [5], that calcium hydroxide liberated from the hydration of calcium silicates controls the formation of ettringite even in the early stage of C_3A hydration. Tricalcium aluminate [6] reacts with excess water to form C_2AH_8 and either or both C_3AH_6 and C_3A . $Ca(OH)_2 \cdot 12H_2O \cdot C_2AH_8$ reacts with $Ca(OH)_2$ to form C_4AH_{13} or C_3AH_6 , depending on the hydration conditions.

The aim of the present investigation is to elucidate the hydration mechanism of C_3A in the presence of $Ca(OH)_2$ (1:1 mole ratio) in paste and in