Influence of sulfates on chloride binding in cements

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Abstract: Cement pastes with water to cement ratio of 0.60 were prepared using three cements with C3A contents of 2.43, 7.59 and 14 percent. The pastes were allowed to hydrate in sealed containers for 180 days and then subjected to pore solution expression. The expressed pore solutions were analyzed for chloride and hydroxyl ion concentrations. It was found that the alkalinity of the pore solution is significantly increased by the addition of sodium sulfate in the chloride-bearing hydrated cement pastes. This is attributable to the formation of sodium hydroxide as a result of reaction between sodium sulfate and calcium hydroxide liberated during cement hydration. The addition of sulfates also caused a significant increase in the chloride ion concentration in the pore solution, for both chloride levels in all the three cements tested. DTA results show that the sulfate addition reduces the formation of Friedel's salt, which possibly results in an increase in the chloride ion concentration in the pore solution. The interactive effect of increase in alkalinity and chloride ion concentration with sulfate addition is not a consistent increase or decrease in the Cl- /OH- ratio of the pre solution. For a given chloride level, whether sulfate addition increases or decreases the Cl-/OH- ratio of the pore solution, and hence the corrosion risk, depends upon the interactive effect of equivalent alkali content and C3A content of the cement.