ACI MATERIALS JOURNAL TECHNICAL PAPER

Title no. 99-M22

Effect of Cement Alkalinity on Pore Solution Chemistry and Chloride-Induced Reinforcement Corrosion

by H. A. F. Dehwah, M. Maslehuddin, and S. A. Austin

This paper reports the results of a study conducted to evaluate the influence of cement alkalinity on the pore solution chemistry and chloride-induced reinforcement corrosion in ordinary and sulfate-resisting portland cements. To evaluate the influence of cement alkalinity on the pore solution chemistry, cement-paste specimens were prepared with a fixed quantity of sodium chloride and varying alkalinity (in the range of a 0.4 to 1.4% Na_2O equivalent). The pore solution was extracted and analyzed to determine the OH^-, Cl^-, and SO_4^- concentrations. The influence of cement alkalinity on chloride-induced reinforcement corrosion was assessed by measuring corrosion potentials and corrosion current density. The results indicated that the OH^-, Cl^-, and SO_4^- concentrations of the pore solution increased with increasing alkali content in the cement. Furthermore, the Cl^-/OH^- ratio decreased with increasing alkali content up to 0.8% Na_2O and, thereafter, increased with further increases in the alkalinity. An improvement in the corrosion resistance of both SRPC and OPC concrete specimens was noted with increasing alkali content of the cement. The greatest improvement, however, was noted when the alkalinity was 0.8% (Na_2O equivalent).

Keywords: alkali-aggregate reaction; corrosion; portland cement; reinforcement.