Influence of Temperature and Carbonation on Chloride Induced Corrosion of Carbon Steel in Concrete Pore Solutions

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The effects of the temperature, carbonation, and different types of synthetic solutions on chloride corrosion of steel reinforcement were investigated in this paper. A relatively wide range of temperatures (from 5°C to 60°C) and three synthetic solutions ($\text{Ca(OH)}_2 + \text{KOH} + \text{NaOH}$ solution, the cement and cement-slag extracts) were applied. In addition, a high concentration of bicarbonate ions (0.2 mol/L) was used to simulate the effect of carbonation. The open-circuit potential and corrosion current density were obtained from the linear polarization resistance and EIS results to evaluate the corrosion resistance of samples. Higher temperatures increase the corrosion of steel above 20°C. This is accounted for by the acceleration of both the corrosion reaction and dissolution of passive films. The lower temperature (5°C) similarly promotes corrosion due to the increased dissolved oxygen in the solutions. The existence of HCO_3^- inhibits the corrosion process in traditional synthetic solutions under 40°C but promotes corrosion at 60°C, which can be attributed to the buffering influence of ions and decomposition. The traditional synthetic solutions and cement extracts are more appropriate for simulation of the effect of temperature and carbonation.

Keywords: temperature, carbonation, chloride ions, reinforcement corrosion, cement, slag

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