Corrosion Inhibition Effect of Molybdate on Fine-Grain High-Strength Reinforcement in Simulated Concrete Pore Solutions Containing Cl^-

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To improve the corrosion resistance of fine-grain high-strength (FGHS) reinforcement, molybdate was investigated as a inhibitor. The influence of molybdate on the corrosion behavior of FGHS reinforcement in simulated concrete pore (SCP) solutions containing 1.0% or 3.5% NaCl was evaluated using polarization, electrochemical impedance spectroscopy, and Mott–Schottky curves. The corrosion products were analyzed using scanning electron microscopy and energy-dispersive X-ray spectroscopy. The results revealed that upon increasing the molybdate content, the corrosion current density (i_{corr}) and donor density initially rapidly decreased and then slightly increased, while the corrosion protection efficiency and impedance first rapidly increased and then slightly decreased. The optimum molybdate was 1.0 g/L. The i_{corr} of the former ($0.058 \mu\text{A cm}^{-2}$) was considerably less than that of the latter ($0.250 \mu\text{A cm}^{-2}$). The Mott–Schottky curves for the former were continuous, whereas some of those for the latter were discontinuous owing to the depletion of a less Fe^{3+} in the corrosion product. Almost no pits on the reinforcement were observed for the former, whereas a few pits were still observed for the latter. Molybdate exhibited good corrosion inhibition of FGHS reinforcement at low chloride concentrations, although other or composite inhibitors should be considered for high chloride concentrations.

Keywords: Reinforcement; Fine grain; Corrosion; Inhibitor; Molybdate

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