Continuous Monitoring of Steel Corrosion Condition in Concrete Under Drying/Wetting Exposure to Chloride Solution by Embedded MnO₂ Sensor

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Corrosion condition of steel in concrete under drying/wetting exposure to chloride ion solution was monitored based on various electrochemical techniques including linear polarization (LP), electrochemical impedance spectra (EIS) and half-cell potential (HCP) through embedded MnO₂ reference electrode. In LP measurement, polarization resistance of steel was equal to the slope of curves. However, in EIS measurement, polarization resistance of steel was calculated by adding the resistance of protective film to the charge transfer resistance derived from EIS data by means of the equilibrium circuit model. Corrosion state of steel was differentiated based on the obtained corrosion current density calculated by the polarization resistance according to the Stern-Geary equation by introducing the "divergent region". Furthermore, potential of steel with respect to embedded MnO₂ reference electrode was higher than -0.400 V, -0.400 to -0.516 V, -0.516 to -0.710 V and lower than -0.710 V for passive state, critical corrosion state, moderate corrosion rate state and high corrosion rate state respectively. Continuous non-destructive monitoring corrosion condition of steel in concrete was achieved through embedded MnO₂ reference electrode via electrochemical techniques.

Keywords: MnO₂, Reinforced Corrosion, Monitoring, Concrete, EIS, LP, HCP, Sensor

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