Electrochemical Investigation of Passive Film Properties on Low Alloy Steel Rebars in Cement Extract and Saturated $\text{Ca}(\text{OH})_2$ Solutions

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In this paper, the differences in the passivation behaviours of low alloy steel rebars in saturated $\text{Ca}(\text{OH})_2$ solution (SC) and cement extract solution (CE) were studied by Mott-Schottky, XPS and cyclic potentiodynamic polarisation (CPP) analyses. The results indicate that the formation rate of a passive film in SC is faster than that in CE at the initial stage of immersion. With the same passivation time, the passive film that formed in CE has a lower self-corrosive current density, a greater film resistance, a thicker film and better stability than the film formed in SC. The passive films formed in SC and CE have the same composition, and they both exhibit n-type semiconductor characteristics, but the passive films formed in CE have a lower donor carrier concentration and better compactness than those formed in SC. The unpassivated steel has a higher critical Cl^- concentration in SC. However, after the steel rebar is passivated for 7 days, the critical Cl^- concentration in CE is higher than that in SC. The critical Cl^- concentration of passivated steel rebars is 4 times higher than that of unpassivated steel rebars, which indicates that passive films can significantly improve the pitting corrosion resistance of steel rebars.

Keywords: Low alloy steel rebars, Mott-Schottky, Cyclic potentiodynamic polarisation, Passive film, Critical Cl^- concentration

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