The Effect of Supplementary Cementitious Materials on the Quality of Passive Oxide Film Developed on Steel Reinforcement Bars in Simulated Concrete Pore Solution

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Abstract : The effect of supplementary cementitious materials (SCMs) with concrete pore solution on the protective properties of the oxide films that form on reinforcing steel bars has been experimentally investigated using electrochemical impedance spectroscopy (EIS) and Tafel Scan. The tests were conducted on oxide films grown in saturated calcium hydroxide solutions that included different representative amounts of NaOH and KOH which are the compounds commonly observed in ordinary portland cement concrete pore solution. In addition to that, commonly used mineral admixtures (silica fume, natural pozzolan and fly ash) were also added to the simulated concrete pore solution. The results of electrochemical tests show that supplementary cementitious materials do have an effect on the protective properties of the passive oxide film. In particular, silica fume has been shown to have a negative influence on the film quality though it has positive effect on the concrete properties. Fly ash and natural pozzolan increase the protective qualities of the passive film. The research data in this area is very limited in the past and needed further investigation.

Keywords : supplementary cementitious materials (SCMs), passive film, EIS, Tafel scan, rebar, concrete, simulated concrete pore solution (SPS)
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