Long- term Corrosion Behavior of Low Carbon Steel Bars Embedded in Building Concrete: Effect of Silica Fume and Dolomite Powder as Partial Replacements of Portland Cement

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In this study, the incorporating effect of different combinations of silica fume (SF) and dolomite powder (DP) into ordinary Portland cement (OPC) on corrosion behavior of carbon steel reinforced concrete was investigated. Electrochemical impedance spectroscopy (EIS) and polarization analyses in 3.5% NaCl were used to obtain electrochemical corrosion data. Fitting of the EIS data to a suitable equivalent electrical circuit showed that the highest corrosion enhancement was achieved for the mixture with SF (40 kg/m³) and DP (80 Kg/m³) in OPC (M4 sample). Polarization measurements also indicated that the M4 sample had the lowest corrosion density, highest corrosion potential with corrosion inhibition efficiency of $\eta = 94\%$. Consistent results of electrochemical measurements and water absorption show that the mineral admixtures enhance the durability of concrete exposed to corrosive agents by preventing the surface of carbon steel bars from reaching the aggressive ions.

Keywords: Corrosion resistance; Dolomite powder and Silica fume; Electrochemical Impedance spectroscopy; Low carbon steel bars; Polarization

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