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Article

Effect of carbon nanotubes (CNTs) on chloride penetration resistance and physical-mechanical properties of cementitious materials

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Abstract: According to currently enforced Eurocode 2 for the design of reinforced concrete structures, it is essential to protect the steel reinforcement from corrosion and concrete from degradation under aggressive environmental conditions such as marine, urban, industrial, soils, to which these are normally exposed. In this context, this experimental study investigates the enhancement of the physico-mechanical properties of common cement-based mortars and the electro-chemical properties of reinforcing steel, through the addition of nanomaterials in the mix. For the experimental set- up, cylindrical and cubic specimens of different dimensions were cast and were partially immersed in sodium chloride solution for eight (8) months. Two (2) groups were considered: cement-based mortar composites with 0.5 wt.% CNTs addition and conventional (reference) specimens without any addition of nanomaterials, for comparison. The influence of adding CNTs on chloride penetration resistance was subsequently evaluated using standardized and non-standardized testing techniques: physico-mechanical tests (flexural strength and porosity), mass loss of steel, electrochemical measurements (corrosion current, HCP) and total chloride content calculation. The test results showed that using CNTs as addition in mortar production led to protection of steel rebars against pitting corrosion; moreover, a significant improvement in flexural strength and porosity of mortars was also observed compared to the reference specimens without CNTs.

Keywords: Carbon Nanotubes; Pitting Corrosion, Corrosion Current; Half-cell Potential; Porosity; flexural strength; Cement-based mortar.