Effect of Clay as a Nanomaterial on Corrosion Potential of Steel Reinforcement Embedded in Ultra-High Performance Concrete

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ABSTRACT
The effect of clay as nanomaterial or nanoclay (NC) on corrosion potential of steel reinforcement embedded in ultra-high performance concrete (UHPC) due to the early age properties of UHPC was investigated. In this present research, ordinary Portland cement (OPC) was partially replaced by NC at 1, 3, and 5 % by weight of cement to produce the nanoclayed UHPC. It is well recognized that the corrosion of steel reinforcement would affect the service life of the reinforced concrete structure performance. To overcome this problem, UHPC was benefited due to its superior characteristic in term of density and durability as compared to OPC concrete itself. In this present research, half-cell potential (HCP) was used to monitor and measure the corrosion potential of steel reinforcement embedded in UHPC and nanoclayed UHPC. Meanwhile, weight loss of corroded steel reinforcement and pH values of hardened UHPC and nanoclayed UHPC were also conducted as follows to the specific procedures. All the samples were immersed in 3 % sodium chloride solution up to 91 days of exposure. The results revealed that the corrosion activity of steel reinforcement embedded in UHPC with 5 % NC recorded the lowest corrosion potential readings compare to those UHPC. It is also shows that the pH value of concrete and weight loss of corroded steel reinforcement in UHPC alone is highest compared to UHPC incorporating different levels of NC. As regards to the results, it is revealed that replacing NC as a replacement to cement significantly enhanced the chloride penetration of nanoclayed UHPC. It is also indicated that the corrosion potential decreased with the increase of NC and as a result delayed the corrosion initiation.

KEYWORDS: Ultra-high performance concrete; Nanoclay; Nanoclayed UHPC; Corrosion potential; Weight loss; pH value

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