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Chloride Permeability of Nanoclaved Ultra-High Performance Concrete

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Abstract— It is widely recognized that the ingress of chlorides into concrete can initiate reinforcement corrosion and ultimately result in deterioration of the concrete structure. Chloride permeability of concrete has been recognized as a critical intrinsic property affecting the durability of reinforced concrete. From the previous research, the use of nano clay (NC) in cement mortar due to chloride permeability has been well-documented. In this paper, the ability of ultra-high performance concrete (UHPC) to withstand the action of chloride penetration were investigated. An experimental research was carried out in order to investigate the influence of incorporating NC material as cement replacement into ultra-high performance concrete (UHPC-NC) on chloride-related transport characteristic. The workability, compressive strength and charge passed in rapid chloride permeability test (RCPT) of UHPC-NC were reported. Those parameters were also determined for normal strength concrete (NPC) and plain without nano clay ultra-high performance concrete (UHPC) as comparison. Three (3) series of UHPC-NC mixes were produced incorporating 1% (UHPC-NC1), 3% (UHPC-NC3) and 5% (UHPC-NC5) of NC replacing cement (OPC). The results showed that incorporating NC in concrete mixes causes a reduction in the workability. It was also found that replacing of OPC with NC improved the strength of UHPC-NC as compared to those mixes without NC material. The optimum NC replacement level recorded at 3% (UHPC-NC3) from the total weight of OPC. For the chloride permeability, it is clearly shown that the presence of NC has important benefit in terms of chloride resistance.

Keywords— ultra-high performance concrete; nano clay; workability; strength; chloride permeability