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EFFECT OF NANO-SILICA ON THE CHEMICAL DURABILITY AND MECHANICAL PERFORMANCE OF FLY ASH BASED GEOPOLYMER CONCRETE

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Abstract

In this study, the effect of nano silica on the short term severe durability performance of fly ash based geopolymer concrete (GPC) specimens was investigated. Four types of GPC were produced with two types of low calcium fly ashes (FAI and FAII) with and without nano silica, and ordinary Portland cement concrete (OPC) concrete was also cast for reference. For the geopolymerization process, the alkaline activator has selected a mixture of sodium silicate solution (Na_2SiO_3) and sodium hydroxide solution (NaOH) with a ratio ($\text{Na}_2\text{SiO}_3/\text{NaOH}$) of 2.5. Main objectives of the study were to investigate the effect of usability or replaceability of nano silica-based low calcium fly ash based geopolymer concretes instead of OPC concrete in structural applications and make a contribution to standardization process of the fly ash based geopolymer concrete. To achieve the goals, four types of geopolymer and OPC concretes were subjected to sulfuric acid (H_2SO_4), magnesium sulfate (MgSO_4) and seawater (NaCl) solutions with concentrations of 5%, 5%, and 3.5%, respectively. Visual appearances and weight changes of the concretes under chemical environments were utilized for durability aspects. Compressive, splitting tensile and flexural strength tests were also performed on specimens to evaluate the mechanical performance under chemical environments. Results indicated that FAGPC concretes showed superior performance than OPC concrete under chemical attacks due

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