World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:14, No:10, 2020

Mineral Slag Used as an Alternative of Cement in Concrete

Authors : Eskinder Desta Shumuye, Jun Zhao, Zike Wang

Abstract : This paper summarizes the results of experimental studies carried out at Zhengzhou University, School of Mechanics and Engineering Science, research laboratory, on the performance of concrete produced by combining Ordinary Portland Cement (OPC) with Ground-Granulated Blast Furnace Slag (GGBS). Concrete specimens cast with OPC and various percentage of GGBS (0%, 30%, 50%, and 70%) were subjected to high temperature exposure and extensive experimental test reproducing basic freeze-thaw cycle and a chloride-ion attack to determine their combined effects within the concrete samples. From the experimental studies, comparisons were made on the physical, mechanical, and microstructural properties in compassion with ordinary Portland cement concrete (OPC). Further, durability of GGBS cement concrete, such as exposure to accelerated carbonation, chloride ion attack, and freeze-thaw action in compassion with various percentage of GGBS and ordinary Portland cement concrete of similar mixture composition was analyzed. The microstructure, mineralogical composition, and pore size distribution of concrete specimens were determined via Scanning Electron Microscopy (SEM) analysis and X-Ray Diffraction (XRD). The result demonstrated that when the exposure temperature increases from 200 ºC to 400 ºC, the residual compressive strength was fluctuating for all concrete group, and compressive strength and chloride ion exposure of the concrete decreased with the increasing of slag content. The SEM and EDS results showed an increase in carbonation rate with increasing in slag content.

Keywords : accelerated carbonation, chloride-ion, concrete, ground-granulated blast furnace slag, GGBS, high-temperature
Conference Title : ICACEE 2020 : International Conference on Architectural, Civil and Environmental Engineering
Conference Location : Bali, Indonesia
Conference Dates : October 22-23, 2020