

Mineral Slag used as an Alternative of Cement in Concrete

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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 comparison with ordinary Portland cement concrete (OPC). Further, durability of GGBS cement concrete such as exposure to chloride ion attack and freeze-thaw action in comparison with various percentage of GGBS and ordinary Portland cement concrete of similar mixture composition were analyzed. The microstructure, mineralogical composition, and pore size distribution of concrete specimens were determined via Scanning electron microscopy analysis (SEM), and X-ray diffraction (XRD). The result demonstrated that when the exposure temperature increases from 200 °C to 400 °C, 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 of slag content.

Keywords: Concrete, GGBS, Crack, Chloride ion, Carbonation, High temperature