

Performance of cement mortar modified with GGBFS at elevated temperatures with various w/b ratios and superplasticizer dosages

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Abstract

The present research aimed to evaluate and analyze the performance of Portland cement mortars that were heated to a maximum temperature of 625°C and contained various amounts of GGBFS, superplasticizer, and water-to-binder ratios. Because of the enormous temperatures they generate, fires have the potential to cause structures made of concrete to collapse. In order to anticipate concrete buildings structural safety in the event of specific accidents or specific service conditions, it's important to consider their behavior under exposure to elevated temperatures. The findings of the tests showed that greater exposure to heat and greater w/b ratios caused greater weight loss. The highest compressive strength for mixes containing GGBFS was found at a temperature of 225°C, but the compressive strength of mixes without GGBFS decreased with increasing the temperature. The flexural strength was proportional with increasing the temperature to 225°C and declined with a further increase to 625°C for mixes with no GGBFS at 0.4 w/b, while for mixes containing GGBFS, the flexural strength decreased with higher temperature. In general, at 0.4 and 0.48 w/b ratios, higher flexural strength was observed for all mixes with elevating the exposure temperature to 225°C, followed by the flexural strength decreasing at 625°C temperature. The splitting tensile at all w/b ratios was enhanced with an exposure temperature of 225°C and degraded at 625°C. Finally, SEM microstructural analysis results indicated that increasing exposed temperature loosens the matrix's microstructure, creating larger microcracks and pores.