Title : Effect of Calcium Sulfoaluminate–Belite Cement for Partial Portland Cement Replacement on Its Mechanical Properties and Microstructure

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ABSTRACT

This study investigated the partial replacement of Portland cement (PC) with calcium sulfoaluminate–belite cement (CSA), with curing periods of 1, 3, and 7 days, to evaluate how different mix proportions affect the setting time and compressive strength of the blended cement. X-ray Diffraction (XRD) analyses were also conducted to examine phase composition. The mix proportion that achieved the highest compressive strength was subsequently selected to determine the appropriate gypsum content required for the hydration of the blended cement. The results indicated that increasing the CSA content up to 20 wt% enhanced compressive strength at curing ages of 3 and 7 days. At 7 days, mixtures containing 0%, 5%, 10%, and 20% CSA with a water-to-cement ratio of 0.3 exhibited compressive strengths of 11.8, 12.7, 14.2, and 14.4 MPa, respectively, with the 20% CSA mixture showing the highest strength, demonstrating its suitability for early-age strength development in the PC/CSA system. The 20% CSA mixture was then partially replaced with varying amounts of gypsum, With an increase in the gypsum content, the compressive strength decreased. Therefore, gypsum replacement should be maintained within an appropriate range, as excessive addition reduces the proportion of primary cementitious materials, which may adversely affect both strength and durability.

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