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Utilization of Commercial Sulfate to Modify Early Performance of High Volume Fly Ash Based Binder

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Abstract

The current study aims at distinguishing the advantages of using commercial sulfate agents consisting of sodium sulfate (Na_2SO_4) and gypsum ($CaSO_4 \cdot 2H_2O$) to improve the setting time and the engineering properties of a high volume Class F fly ash (HVFA) paste at early ages. Experimental results showed that both types of sulfate activators as added in the HVFA paste shortened the setting time and increased the compressive strengths of the hardened paste specimens at all days, especially at early ages of 1-7 days. The improved macro-behavior of the HVFA pastes modified with sulfate in comparison with the reference specimens without sulfate was associated with the microstructural refinement due to the increased ultrasonic pulse velocity (UPV) measurement induced by the extra hydration products contributed to the dissolution of fly ash particles as detected by using scanning electron microscope (SEM). In this study, using Na_2SO_4 to enhance the setting time and early compressive strength of the HVFA paste was more efficient than using $CaSO_4 \cdot 2H_2O$. On the other hand, the $CaSO_4 \cdot 2H_2O$ distinguished its' superior benefit on lowering the hydration heat released of sulfate modified HVFA pastes.

Keywords: Class F fly ash; Sulfate activator; High volume fly Ash; Setting time; Early engineering properties

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