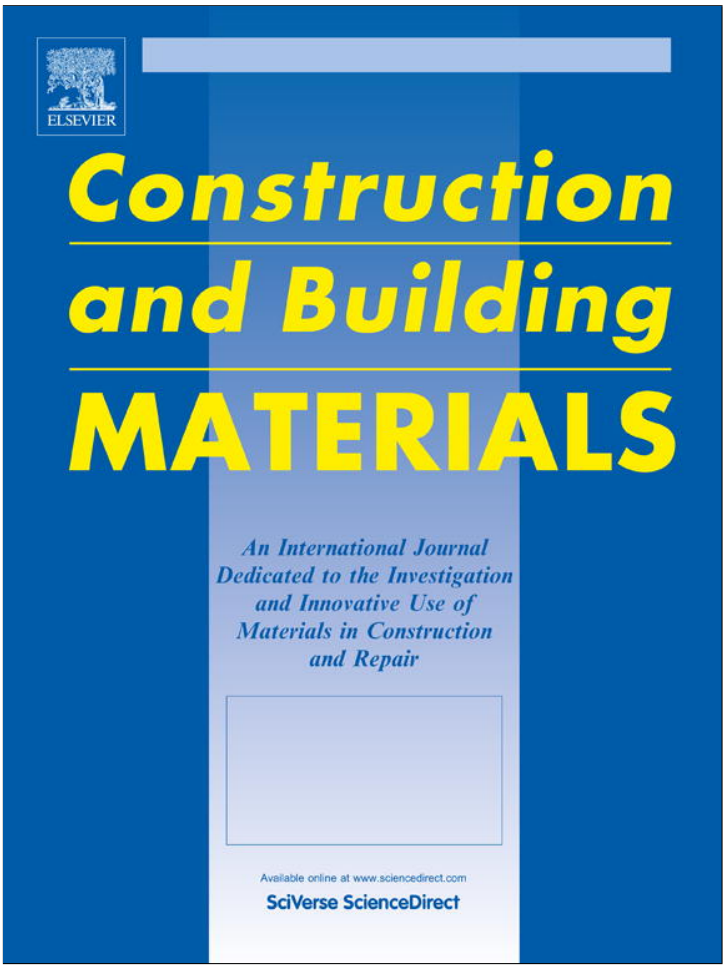

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Influence of delayed addition time of sodium sulfanilate phenol formaldehyde condensate on the hydration characteristics of sulfate resisting cement pastes containing silica fume

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HIGHLIGHTS

- Delaying addition time enhances fluidity of cement pastes.
- Delaying addition time leads to increase the compressive strength and bulk density of cement pastes.
- Whereas it decreases the total porosity of cement pastes up to 90 days.
- Optimum composition is obtained with 1.5 mass% at 10 min delayed addition time.

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ABSTRACT

The water–silica fume–cement system is highly sensitive to the effect of superplasticizers. This work aimed to study the individual effects of the dosage and delayed addition time of laboratory synthesized sodium sulfanilate phenol formaldehyde condensate (SSFP) on the hydration characteristics of sulfate resisting cement (SRC) pastes incorporating 10 mass% SF and hydrated up to 90 days. Initial and final setting times, compressive strength, bulk density, total porosity and hydration kinetics were determined. Some selected specimens were analyzed using IR spectroscopy. The results showed that the fluidity of cement pastes increases with SSFP dosage and delayed addition time up to 10 min this is due to the electrostatic repulsion between cement particles and the decrease of C_3A content that is minimized by hydration until the dormant period (10–15 min). The values of combined water, compressive strength and bulk density increase with polymer content up to 1.5 mass% with delayed addition time up to 10 min; this is intrinsically associated with the reduction of W/C ratio with polymer content as well as the improvement of superplasticizing effect of SSFP with delayed addition. IR spectra are in a good agreement with the results of physico-chemical and mechanical properties. The synthesized SSFP condensate could improve the fluidity, bulk density and compressive strength of the investigated cement pastes.

1. Introduction

The production of sulfate resisting cement (SRC) is expected to increase because of its high durability against attack of sulfates and chlorides in soils, seawater and/or ground water. The heat developed by SRC is lower than OPC. Therefore, it could be argued that, it is used as suitable cement for massive structures exposed to seawater or ground water [1].

Pozzolanic cements containing active mineral admixtures such as fly ash (FA), blast-furnace slag (BFS), silica fume (SF) or natural pozzolana have demonstrated to be sulfate resistant due to pore size refinement, C_3A dilution, and CH removal by pozzolanic reaction [2].

Silica fume (SF) is a byproduct of the smelting process in the silicon and ferrosilicon industry. Because of its extreme fineness and high silica content, SF is a highly effective pozzolanic material. Effect of SF in cement mortar or concrete can be studied basically under three roles: pore-size refinement and matrix densification, pozzolanic activity with free lime to form additional calcium silicate hydrate (C—S—H) and cement paste-aggregate interfacial refinement [3]. As cements containing SF exhibit higher compressive strength than non-blended cements, it is used to manufacture high strength concrete. Its incorporation also affects fresh cement

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