

Hydration and rheology of sulfoaluminate-belite in presence of polycarboxylate superplasticizers (PCE) and citric acid

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Abstract

A promising low CO₂ alternative to Portland cement is sulfoaluminate cement (CSA) containing mainly ye'elinite (C₄A₃S), belite (C₂S) and ferrite (C₄AF). Hydration kinetics of these cements is controlled by the amount of calcium sulfate they contain. The main hydration phase of CSA cements is ettringite. Its formation has consequences on the workability. Polycarboxylate based superplasticizers (PCE) can be used for fluidity improvement, while citric acid can be used for hydration delay.

The aim of this work is to provide a better understanding of the hydration process as well as workability properties, at early ages, of CSA cements containing polycarboxylate-based superplasticizers and citric acid. Citric acid and three polycarboxylate superplasticizers with various side chains density and lengths were studied. On one hand, different type of PCE used shows a significant increase in the initial workability of the pastes. However, a remarkable loss of workability occurs during the first 30 minutes. Besides, the structure of these superplasticizers plays an important role on fluidizing efficiency. On the other hand, citric acid acts mainly on hydration delay. Yield stress of cement paste was measured using both rheometry tests and mini-cone tests, it could be found that the combination of PCE superplasticizer with citric acid helps maintaining a significant yield stress over time to the cement paste compared to PCE alone.

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