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Effect of calcium sulfate source on the hydration of calcium sulfoaluminate eco-cement

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Abstract

The availability of cements, including eco-cements, with tailored mechanical properties is very important for special applications in the building industry. Here we report a full study of the hydration of calcium sulfoaluminate eco-cements with different sulfate sources (gypsum, bassanite and anhydrite) and two water/cement ratios (0.50 and 0.65). These parameters have been chosen because they are known to strongly modify the mechanical properties of the resulting mortars and concretes. The applied multi-technique characterization includes: phase assemblage by Rietveld method, evolved heat, conductivity, rheology, compressive strength and expansion/retraction measurements. The dissolution rate of the sulfate sources is key to control the hydration reactions. Bassanite dissolves very fast and hence the initial setting time of the pastes and mortars is too short (20 min) to produce homogeneous samples. Anhydrite dissolves slowly, at 1 hydration-day, the amount of ettringite formed (20 wt%) is lower than that in gypsum pastes (26 wt%) ($w/c=0.50$), producing mortars with lower compressive strengths. After 3 hydration-days, anhydrite pastes showed slightly larger ettringite contents and hence, mortars with slightly higher compressive strengths. Ettringite content is the chief parameter to explain the strength development in these eco-cements.

Keywords: LXRPD, Rietveld method, Impedance spectroscopy, Temperature, Rheology, Mechanical strength.

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