Influence of temperature on calcium sulfoaluminate cement properties

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Portland cement is the most used cement for construction materials in the world. However, it generates CO₂ mainly from the primary fuel use in the process and the decarbonation of limestone. To lower CO₂ emission, the alternative binders, a non-Portland cement system, are studied. A promising low-CO₂ binder is called calcium sulfoaluminate cement (CSA). This type of binder has a different phase composition based on ye’elimite (C₄A₃S) as one of the main components. They are synthesized at lower temperature and use less limestone when compared to Portland cement. The composition of CSA generally contains high Al content because the amount of ye’elimite becomes more important in the system. Since the composition is unlike Portland cement, the hydration reaction is different leading to the change of phase assemblages, microstructure and properties of cement. Moreover, an important parameter affecting the properties of cement is temperature. The elevated temperature accelerates the reaction of cement. It causes the transformation of the microstructure and phase stability, leading to strength reduction and degradation of the hardened paste.

The aim of this study is to investigate the properties of CSA cement which is synthesized by a static furnace. Mechanical properties (compressive strength) and durability (Cl⁻ diffusion) of the samples cured at 5, 20, 40 and 60°C will be observed.

Work scope:

1. Clinker synthesis
   Tasks: prepare the materials and synthesize the CSA clinker.
   Equipment: Furnace and X-ray diffraction (XRD)

2. Compressive strength test
   Tasks: Casting mortar bars (cement + sand + water) and run the test
   Equipment: Mortar molds, saw and compression machine
3. **Effective diffusion coefficient**  
   *Task:* Prepare the sample for the test, setup the equipment, sampling the solution and titrate the amount of Cl⁻ over time  
   *Equipment:* mini-migration setup and titration machine

4. **Microstructure analysis**  
   *Tasks:* Investigate the microstructure of cement paste  
   *Equipment:* Polishing machine, carbon coating and scanning electron microscope (SEM)