Up-scaled Production of Hydrates

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Objectives:
This project investigates the hydrated matrix of calcium-silicate-hydrates (C-S-H) with different chemical compositions and their up-scaled properties. Studying transport properties leads to a better understanding of durability issues in concrete.

Upscaling C-S-H Production

The material used for this study was a reactive belite binder, which can be synthesized using industrially available equipment. Hydration of this binder lead to a microstructure containing a homogenous C-S-H with high Ca/Si ratio (>1.9) and no portlandite, when the water-to-binder ratio was low (<0.35). There were no alkali ions in the pore solution.

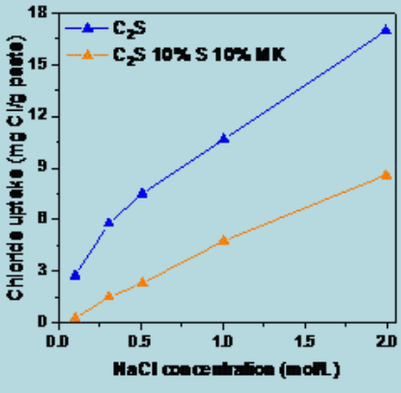
Microstructure Characterizion

Mixtures with silica and metakaolin were hydrated and the microstructure was investigated. With more than 50% silica reacting with Ca from C-S-H, the average value of the Ca/Si ratio decreased to 1.2. The microstructure had less total porosity, determined by mercury intrusion porosimetry and lower critical pore diameter.

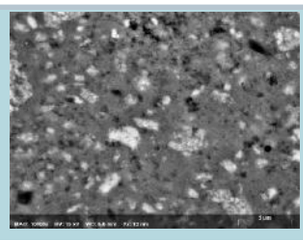
Transport through Microstructure

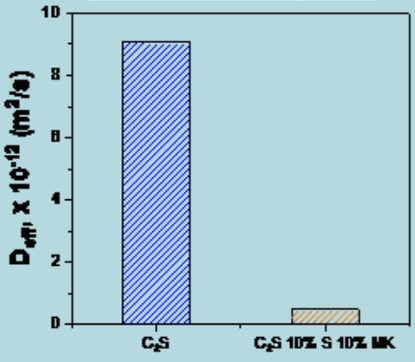
By exposing the C-S-H microstructures to solutions containing chloride, it was found that with high content of silica and/or metakaolin, the adsorbed chloride content is greatly reduced. The diffusion coefficient, determined by accelerated mini-migration experiments, was lower for C-S-H systems prepared with gypsum, silica and metakaolin.

How can this help us understand properties of Portland Cement?



This work provides fundamental understanding regarding the interaction between C-S-H and chloride ions. Experimental results have shown that some C-S-H microstructures, even in the absence of aluminate phases, can accommodate low amount of chloride and still have low chloride diffusion coefficients. In future work it will be possible to better understand the correlation between the chemical composition of C-S-H, its surface properties and kinetics of chloride transport.





For further information please refer to the following link: https://www.erica-etn.eu/

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