



# 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

Hydration of ordinary Portland cement leads to a microstructure containing more hydrated phases. A reactive belite binder can be synthesized using industrially available equipment. For the same degree of hydration, the reactive belite will form more C-S-H and less  $\text{Ca}(\text{OH})_2$  compared to ordinary Portland cement.

## Characterization

We perform hydration studies on the reactive binder and investigate the chemical composition and microstructure of resulting C-S-H by conventional methods (X-Ray diffraction, thermogravimetric analysis, mercury intrusion porosimetry, scanning electron microscopy). Total hydration of the binder is achieved fast and the resulting microstructure has been shown to be homogenous in terms of Ca/Si ratio.

## Transport through Microstructure

After the microstructure is characterized, hydrated samples in saturated state are exposed to solutions containing chloride ions. Adsorption of chloride ions on the C-S-H surface as well as diffusion/migration of chloride through the pore network are the two main processes to be considered.

## How can this help us understand Portland Cement?

This project will provide fundamental understanding regarding the interaction between C-S-H and chloride ions.

Additionally, by changing the Ca/Si ratio of the C-S-H and incorporating ions that are usually present in the hydrated OPC ( $\text{Al}^{3+}$ ,  $\text{SO}_3$ ,  $\text{Na}^+$ ) the chemistry of C-S-H, its surface properties and the composition of the pore solution will change and thus the transport properties will be affected.

