Growth and Synthesis of Hydrates

Maya Harris
Ecole Polytechnique Fédérale de Lausanne, CH

Objectives:
In this project, synthetic calcium silicate hydrate (C-S-H) is produced at high Ca:Si molar ratios with controlled amount of oxide compositions and water contents. Kinetic and thermodynamic modelling will be employed to study this system.

Synthetic C-S-H

In cementitious systems, C-S-H precipitation often occurs with the formation of other phases including ettringite, Ca(OH)2, and CaCO3 Additionally, C-S-H has a variable stoichiometry and water content. As a result, this project focuses on studying C-S-H in an isolated system.

Sample Preparation

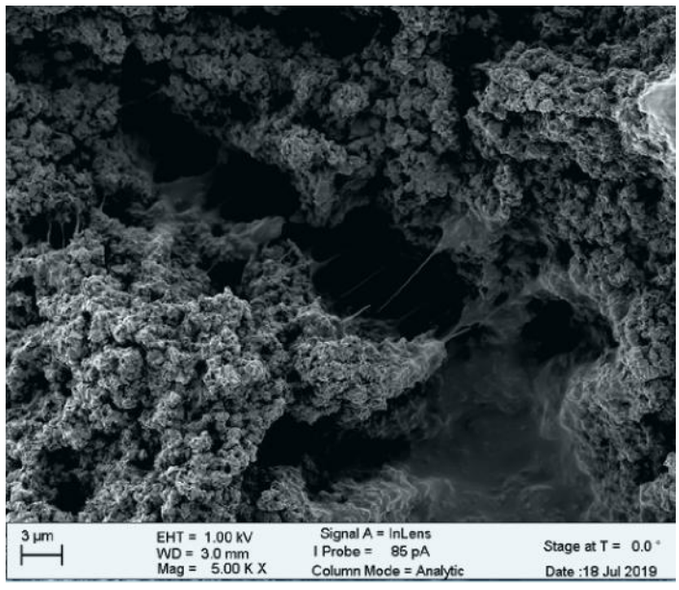
Pure-phase C-S-H is synthesized in a process combining double decomposition and dropwise precipitation. Calcium and silicate solutions at supersaturation conditions in respect to C-S-H are combined at a high pH while controlling temperature and mixing. The precipitate is collected after 3-5 hours of equilibration, and is handled carefully so as to prevent the formation of other phases post-synthesis.

Characterization

X-ray diffraction and thermogravimetric analysis are used to quantify the C-S-H samples and the presence of any additional phases. Inductively-coupled plasma spectrometry and x-ray fluorescence are used to quantify the produced Ca:Si molar ratios. Electron microscopy are used to analyze the morphology of the produced samples.

Modelling Growth & Nucleation Kinetics

During the synthesis of C-S-H, kinetic data is collected with a Ca2+ ion electrode. This data is then applied to a population balance model which combines a mass balance on the system with population size distributions and thermodynamic information to predict how synthetic C-S-H nucleates and grows over time. In the scope of this project, the effect of sulfates on growth & nucleation kinetics is being modelled.



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