Early stages of the formation of nanocrystalline C-S-H colloids

BESSELINK, R. [1], POULAIN, A. [1], GOBERNA-FERRON, S. 1) ASTA-ANDRES,[1] M. P., VAN DRIESSCHE, A.[1], FERNANDEZ-MARTINEZ, A.[1]

[1] ISTerre, Univ. Grenoble Alpes & CNRS, 1381 rue de la Piscine, 38041 Grenoble, France. Corresponding Autor : Rogier Besselink, besselir@univ-grenoble-alpes.fr.

Calcium silicate hydrate is the primary binding component of concrete, making it one of the most important construction material of the modern world. Nevertheless, due to its complex nano-crystaline and nanocomposite nature, the large varieties of defects that can occur within its structure and the fast dissolution/reprecipitation dynamics, its formation mechanism is still a subject of debate. Previous studies revealed that calcium silicate hydrate forms through a two-stage process: i.e. a fast nucleation of nano-crystalline colloidal nuclei, followed by a slower formation of aggregates that retain its initial nano-crystalline morphology.

Here we present a new set of experiments based on state-of-the-art, in situ, High Energy X-ray Scattering (HEXS) and pair distribution function analysis, which alowed us to resolve the basic structural motivs of the initial building blocks that are formed prior to the crystallization of β-CSH. The identification of these initial building blocks will clarify the structural transitions through which CSH is formed and consequently help us understanding the basic kinitecs of CSH-formation processes. A fundamental understanding of these processes will contribute towards high-performance custom-made cements.