

Addition of amorphous nanosilica in C₃S hydration

¹Isabel F. Sáez del Bosque.; ²Manuel Martín-Pastor; ^{1,3} Sagrario Martínez Ramírez.;

¹M. Teresa Blanco-Varela.

i.fuencisla@ietcc.csic.es or isa.f.saez@gmail.com

¹ *Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc-CSIC), c/ Serrano Galvache 4, 28033 Madrid, Spain*

² *Unidad de Resonancia Magnética, RIAIDT, edif. CACTUS de la Universidad de Santiago de Compostela, Campus Sur, 15782 Santiago de Compostela, Spain*

³ *Instituto de Estructura de la Materia (IEM-CSIC), c/ Serrano 113, 28017 Madrid, Spain*

This study explores the addition of amorphous nanosilica (nSA) in triclinic (T₁) tricalcium silicate hydration and its effect on C-S-H gel nanostructure and composition. Two types of pastes were prepared from laboratory-synthesised C₃S and deionised water. The first contained 100 wt% C₃S and the other 90 wt% C₃S + 10 wt% nSA. Both were cured at 100 % RH and analysed with ²⁹Si MAS NMR, XRD, DTA/TG, FTIR and TEM/EDS. The findings showed that the mechanism governing C-S-H gel formation in the reaction between nSA and portlandite differed from the mechanism involved in pure C₃S hydration. The high pozzolanicity nSA used accelerated C₃S hydration, favouring the generation of C-S-H gels whose drierkette-like silicate chains were initially longer than in non-nSA gels. Over time, the mean chain length of these gels gradually declined, unlike what has been observed in nSA-free pastes, where MCL rises with hydration time. Nonetheless, the mean length of the chains formed during C₃S + nSA hydration was always greater than in the unadditioned material. Moreover, the inclusion of nSA changed the proportion of tobermorite- and jennite-like species in the C-S-H gel nanostructure: the former prevailed over the latter, giving rise to lower Ca/Si ratios than found in pastes containing no nSA. Lastly, nSA-free gel morphology is globular (type E), whereas the early age nSA-bearing gels studied exhibited needle- or fibre-shaped particles (types 1 or 3).