

Crystallization and colloidal stabilization of Ca(OH)₂ in the presence of additives.

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Slaking of CaO in water produce Ca(OH)₂ crystals which in the presence of an excess of water result in a slurry, called lime putty, used in lime mortars since Roman times. Traditionally, a wide range of natural additives have been added to the lime putty to improve its quality. However, little is known about the ultimate effects of additives on the crystallization and microstructure of hydrated lime. The pectin-like mucilaginous juice extracted from nopal cladodes, pure pectin from citrus fruits, and lignosulfonic acid, a by-product of papermaking industry used as additive in Portland cement, have been selected in the present study due to their historical use as natural additives in the case of nopal juice and/or their application in modern cement-based binders.

Titration experiments were performed in order to study the influence of the aforementioned natural additives on the early stages of Ca(OH)₂ crystallization.. Free-Ca²⁺ concentration, pH, conductivity and solution transmittance were continuously monitored during portlandite precipitation in the presence and absence of additives. Afterwards, Ca(OH)₂ precipitates, collected at selected elapsed times, were ex-situ analyzed by means of PXRD, FE-SEM, HRTEM, and FT-IR.

Additives were proved to act as (i) nucleation inhibitors, either stabilizing or destabilizing pre-nucleation species, thereby promoting the formation of nanosized crystals, and as (ii) habit modifiers, favoring the development of planar habit. Additives also promote steric stabilization of the portlandite nanoparticles, limiting agregation and thus enhancing the colloidal nature of the lime putty. Overall, these effects are very favorable for the preparation of highly plastic lime mortars with enhanced properties.