

Penka I. Girginova, Cristina Galacho, Rosário Veiga, António Santos Silva, António Candeias,

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Title: Study of mechanical properties of alkaline earth hydroxide nanoconsolidants for lime mortars

Abstract: This research intends to study and optimize successful preparative strategies of nano to sub-micro limes, and to improve their efficiency in the inhibition of the degradation process and in the consolidation of wall renders. In this article we report the synthesis and characterization of nanoparticles based on alkali-earth metal hydroxides, precisely calcium and magnesium hydroxides nanoparticles ( $\text{Ca}(\text{OH})_2$  and  $\text{Mg}(\text{OH})_2$ ) dispersed in ethanol and 2-propanol, for cultural heritage restoration. We discuss the tests conducted to assess the mechanical properties' alteration of lime mortar specimens treated with these nanolimes (superficial hardness, dynamic elastic modulus, compressive and flexural mechanical behaviour). Particularly, the influence of the dispersions' concentration, number of applications (layers) and the slope of the treated surface during the dispersions application on the mechanical properties has been studied. The treatment with nanolime resulted in an improvement of the mechanical properties of the treated specimens. This effect is proportional to the number of layers applied and to the concentration of the alcohol dispersion applied. We also report our attempt to achieve better particles morphology by the addition of surfactants: the non-ionic t-octylphenoxypolyethoxyethanol (Triton X-100) in the synthesis of  $\text{Ca}(\text{OH})_2$  and the cationic hexadecyltrimethylammonium bromide (CTAB) in the synthesis of  $\text{Mg}(\text{OH})_2$ .

Keywords: Nanoconsolidants; Cultural heritage; Nanolime; Lime mortars; Mechanical properties; Inorganic nanomaterials; Wall paintings; Magnesium hydroxide; Calcium hydroxide