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NANO-MECHANICAL CHARACTERIZATION OF NANO-MODIFIED LIME –BASED RESTORATION MORTARS

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Restoration structural mortars are mixtures of binders (either normal lime or natural hydraulic lime NHL) with fine and coarse fillers or aggregates; fine aggregates of carbonate or silicate nature. Restoration mortars are used for the filling and strengthening of masonry or the consolidation and preservation of mortar stratification. The common practice for the consolidation of historic mortar surface layers such as in case of murals, floor wall mosaics, renders was the use of ready mixed (usually cement based) binders or of synthetic resins usually cement based binders or of synthetic resins. The study presents totally 16 compositions of lime-based mortars mixtures containing admixtures and nano-particles were designed, manufactured and experimentally tested in order to evaluate the effect of nano-materials in the hydrolysis and carbonation of the lime binders widely used in the design of restoration mortars; the improvement and upgrading of their microstructures, texture and the physical, mechanical and dynamic properties like dynamic Young's modulus and wave velocity trough the mortars specimens. The volume stability and shrinkage deformations were points of interest of the derived mortars. The use of nano admixtures has showed positive effects provided that proper selection and proportioning of binders is made, so as high performance and compatibility with the old masonry materials to be achieved. The micro analysis and mechanical characterization indicated that the mortars with the nano-titanium and nano-silica additions showed improved mechanical properties over time when compared to the specimens without nano-admixtures. The results evidenced carbonation and hydration enhancement of the mortar mixtures with nano-titanium and nano-silica. The addition of silica and titanium nano-particles can enhance their properties since they decrease the Ca/Si of C-S-H compounds and increase the mean silicate chain length, leading to a C-S-H matrix of long-term stability.

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