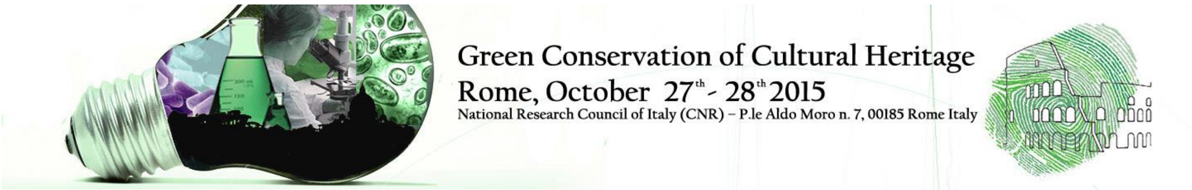

Deposition of modified nanolimes within calcareous substrates

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An important part of the Built Heritage is made of calcareous stone and lime-based plasters and renders. These materials generally show a good durability, but may sometimes suffer from weathering processes that can lead to loss of cohesion of the surface layer (e.g. powdering, chalking). Unfortunately, when considering calcareous materials, there is a lack of efficient and compatible treatments for surface consolidation [1].

Nanolimes intend to overcome the limitations of the traditionally used, but not very compatible, consolidants (e.g. ethyl silicate) [2] and have demonstrated to be able to properly recover very superficial decohesion (e.g. for mural paintings) [3].

However, nanolimes do not always guarantee a mass consolidation, necessary e.g. in the case of decayed stone or render. In fact, lime nanoparticles may, depending also on the substrate properties, partially migrate back towards the surface during drying of the treatment, resulting in a poor consolidating effect in depth [4-6]. In order to solve this problem, a modification of the solvent appears a promising strategy to enhance a more homogeneous nanolime deposition in depth in the treated substrate.

As a first step, in this research the behaviour of newly synthetized nanolimes, synthetized by solvothermal reaction of metallic calcium, has been studied. Nanolimes were then dispersed in different solvents (ethanol, isopropanol, butanol, water).

The kinetical stability of the colloidal dispersions was studied by Uv-Vis spectroscopy; the absorption and drying kinetics of the nanolimes, when applied on coarse porous Maastricht limestone, fine porous Migné limestone and a lime-based render, was measured. The transport of the nanolime during absorption was investigated by phenolphthalein test and photographically monitored. The deposition of the lime nanoparticles in the stones and mortar was studied by phenolphthalein test and by optical microscopy and Scanning Electron Microscopy equipped with Energy Dispersive X-ray spectroscopy (SEM-EDS).

The results show that both the type of solvent (and thus the stability of the nanolime) and the moisture transport properties of the substrate influence the deposition of the nanolime particles in the treated material. This suggests that an appropriate mixture of solvents, fine tuned to adapt the stability of the nanolime to the moisture transport properties of the substrate, can optimize the deposition of the nanolime in depth. First trials show that a combination of alcohol and water could lead to a strong improvement of in depth deposition.

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