

NANOMATERIALS FOR CONSOLIDATION OF MARBLE AND WALL PAINTINGS

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The extensive use of commercial organic polymers over the last 50 years for historical conservation treatments of stone and wall paintings has shown its limits in terms of durability and retreatability. Tailor-made inorganic nano-sized molecules based on calcium alkoxides have been investigated as they are thought to be most likely the most compatible materials with these substrates when facing up to sugaring or powdering issues.

This paper presents the study of calcium alkoxides from their synthesis to the final application as CaCO₃ precursors for calcareous materials consolidation. These innovative nano-structured materials have been specifically designed to reach the requirements of compatibility and effectiveness when consolidating cultural heritage carbonaceous substrates such as marble and wall paintings.

The first step was the selection of the molecules by the evaluation of their solubility and stability in methanol, ethanol, isopropanol, butanol and the characterization of the compounds by NMR and FT-IR, of their decomposition process by FT-IR and of the final crystalline phases (portlandite, vaterite, calcite) after carbonation of the alkoxides by XRD. Then we selected two types of substrates in order to test their performances : samples of Carrara marble (5x5x1 cm) and wall paintings specimens of frescoes and *a secco* techniques of green earth, yellow ochre, azurite, lead-tin yellow and cinnabar-white lead mix. Variations of ultrasonic velocity, observations of the coatings by FEG-ESEM and spectrophotometric measurements were done to evaluate the consolidation effects of the alkoxides and the absence of side-effects such as whitening on polychrome. The calcium triethylglycolmonoethylether (Ca(TEGmEE)₂) gave the best results for all the specifications and for both substrates.

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