NANOMATERIALS FOR CONSERVATION OF PEPERINO ARTWORKS



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The aim of the regional project COLLINE, "Preservation of stones by using essentials oils and nanotechnologies", granted by Regione Lazio in the framework of DTC-Lazio, is to develop, test and evaluate a protocol for the preservation of damaged surfaces of monuments under restoration, in real conditions. This goal can be obtained thanks to the synergistic use of innovative materials for conservative restoration, such as nanomaterials and essential oils, together with modern and innovative diagnostic and sensor techniques and the computerization of data, updated in real time, for remote monitoring and management

Two sites in the city of Viterbo, the Basilica of San Francesco alla Rocca and the Fountain of San Faustino (about 1250), were selected for testing both biological materials (i.e. essential oils or enzymatic complex) and synthetic materials (i.e. organic polymers), and also nanostructured materials. Planned treatments allow not only immediate recovery of the manufacture, but also its long-lasting protection from outdoor agents, such as moisture and biological attacks.

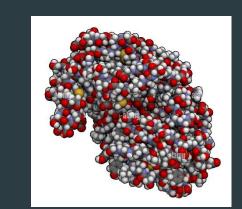
In addition, the application and testing of integrated innovative techniques, aimed at a digitalization of the interventions and the results of the investigations, have the dual objective of making them usable on a large scale and manageable and monitorable remotely, ensuring, in this way, a considerable simplification of maintenance processes and a consequent minimization of the costs due to them.

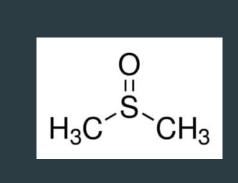
COMMERCIAL MATERIALS FOR RESTORATION TREATMENT

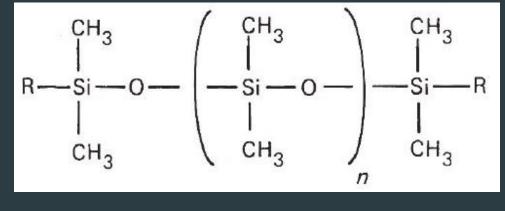
Protective materials: biocide effect

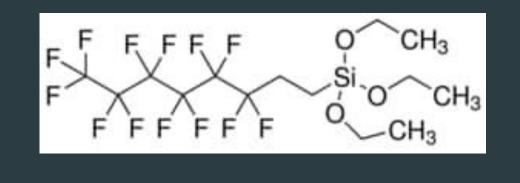
Consolidant materials: hydrophobicity and consolidant properties













Essential oils Enzymatic complex **DMSO**

Rhodorsil

Nano silo OR (CTS)

Nano silo W (CTS)

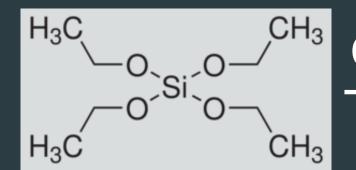
INNOVATIVE NANOCOMPOSITE: the challenge is merging together the main features and properties of oxide nanoparticles and polymeric system.

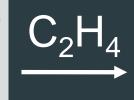
LASER SYNTHESIS OF NANOPARTICLES

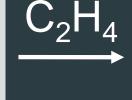


SiO₂ and TiO₂ nanoparticles were synthesized by using CO₂ laser pyrolysis of an aerosol of liquid precursors in a gas-flow reactor.

In this process the nucleation and growth of NPs result from laser induced chemical reactions at the crossing point of the laser beam with the molecular flow of gas or vapour-phase precursors. Chemical features and dimensions of nanoparticles can be easily tuned by varying process parameters such as: reagents fluxes, laser power, pressure in the reaction camera. This method shows many advantages due to its intrinsic features: small nanoparticles are spherical, produced in developmental quantities, with narrow size distribution and free by organic contaminants.



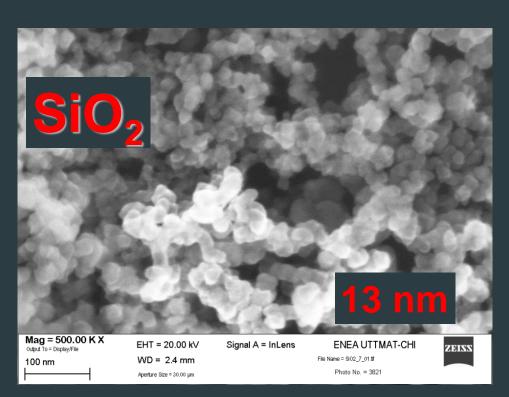


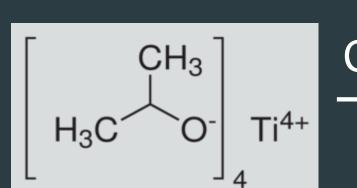


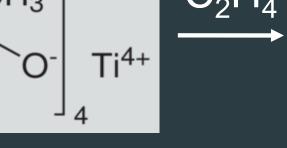




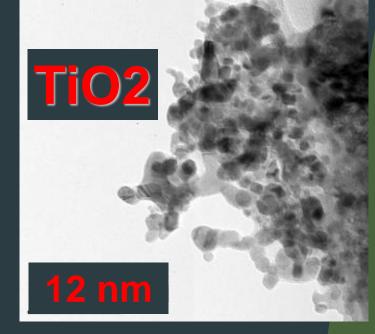












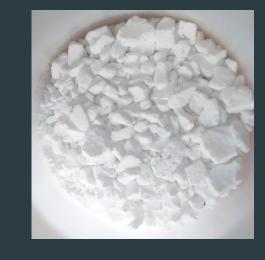


self-cleaning

PREPARATION OF NANOCOMPOSITES



Rhodorsil RC70 or Rhodorsil WR224



TiO₂ 0.2 % w/v



SiO₉ 0.2% w/v



nanocomposites

The application of nanomaterials is enabling new functionalities that promise to improve the properties of traditional commercial products. In particular SiO_2 and TiO_2 nanoparticles, due to their unique physico-chemical characteristics, exhibit improved performance over traditional chemical compounds for the conservation field. The modulation of physical and chemical properties of a polymer-based protective coating can be obtained by a proper blending of the coating material with suitably chosen NPs. This way, the developed NCs can be accurately tailored to the different purposes required from the considered application.











Ultrasonic tip

