Poster

Consolidating stone materials by means of nanoparticles

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Petrology has turned into a fundamental discipline for the step forward in research and conservation of architectural and monumental heritage, in the causes generating its decay, as well as in the most adequate conservation and protection techniques according to materials´ petrophysical characteristics and the type of environment in which materials are located [1]. Most of the materials deterioration is directly related to intrinsic aspects of them, such as textural and compositional properties, porosity, and the alteration degree of the existing minerals constituting the rock. Besides, there are some extrinsic factors related to the environment in which they are placed (climatic, environmental, biological and antropic, etc), which contribute in a different way to the degradation of monuments.

The development in the last years of nanotechnology and nanoscience, and the interest they arise, is due to the fact that at nanometric scale, materials behaviour changes as a result of the size decrease. Lately, nanotechnology is being considered as an opportunity to be applied in the field of rocks and stone conservation. Among the consolidants used to restore the lost cohesion of the stone materials employed in architectural heritage, calcium hydroxide has been extensively used and is well known. The existence of different methods of nanoparticle synthesis to be applied for stone materials conservation [2], has increased the possibility of assess the effect of consolidants as the nano-calcium hydroxide applied to carbonatic rocks, in different environmental conditions; this compound helps the carbonation processes and improve physical and hydric properties.

The synthetized products exhibit different mophological, structural and chemical characteristics according to the synthesis method that has been used, being susceptible to factors such as relative humidity [3], time of exposure to the product, temperature and textural and mineralogical aspects of the stone materials on which it has been applied. The study of the effect of the nanoparticles-based consolidant products obtained by different synthesis methods, will allow to assess their behaviour at a nanometric scale, their morphological-crystalline evolution, and also to analyse their reaction with different surfaces to which they have been exposed. At the same time, it will be possible to evaluate the behaviour of these consolidants at different environmental conditions with the aim of improving the physico-chemical properties of the stone materials.

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References:

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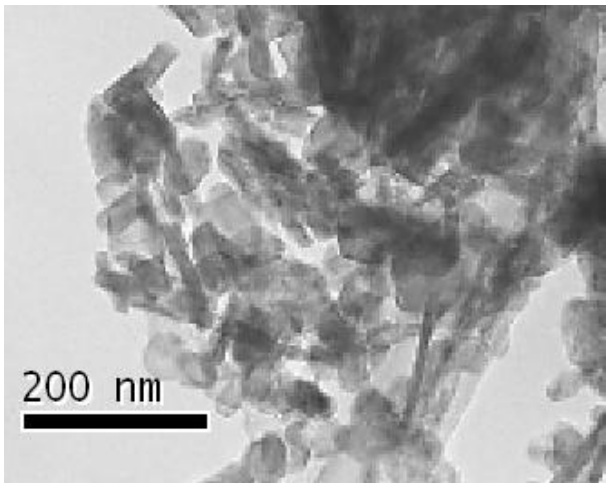
[2] Ziegenbald, G. Colloidal calcium hydroxide- a new material for consolidation and conservation of carbonate stone, Proceedings of 11th International congress on deterioration and conservation of stone, (2008). vol. III 1109p.

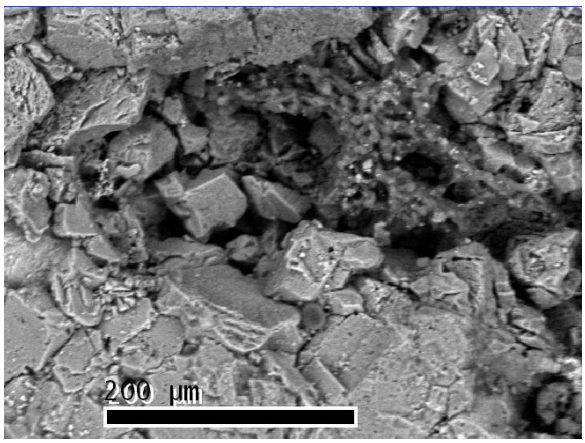
[3] López-Arce, P,.Gomez-Villalba, L.S., Pinho, L., Fernández-Valle, ME. Álvarez de Buergo M., Fort R. 2010. Influence of porosity and relative humidity in the consolidation of dolostone with calcium hydroxide nanoparticles: assessment of consolidation effectiveness with non destructive techniques. Materials Characterization, 61 (2): 2010, pp.168-184 DOI: 10.1016/j.matchar.2009.11.007.

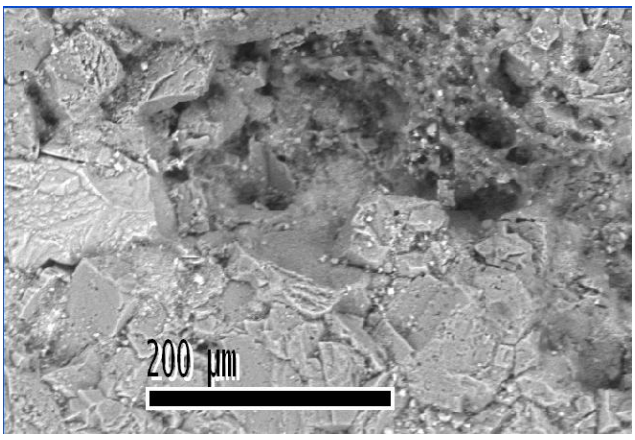
Figures:



TEM image of a comercial consolidant product based on colloidal calcium hydroxide nanoparticles (a).

a)





b) **c)**

ESEM images of dolostone treated with the consolidant before (b) and after 20 days treament at 33% relative humidity (c). Porosity and roughness are modified.