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INNOVATIVE SOLUTIONS BASED ON NANOMATERIALS FOR PROTECTION AND CONSERVATION OF CULTURAL HERITAGE MONUMENTS

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Abstract: Conservation science as one of the most complex topics in the materials science, requires complex investigations from the history of art, archaeology, analytical and physical chemistry. Recent researches has shown that the complex tasks of the conservation of the cultural heritage can be solved using novel nanomaterials and nanotechnology procedures [1]. The development of new nanomaterials for the conservation and restoration area has been investigated for solving several problems, such as incomplete lime carbonation process, limited depth penetration and the formation of thin white superficial layers. The aim of this paper is to test some nano-consolidants based on hydroxyapatite, metallo-hydroxyapatite (Mg, Sr, Ba), $Ca(OH)_2$, $Mg(OH)_2$ for consolidating the chalk stone used in Basarabi Church building monument from Dobrogea region (Romania). This monument was built from amorphous calcium carbonate and very sensitive to humidity, frost, salts, infiltration, etc. [2]. The synthesized nanoparticles have been analyzed by X-rays Diffraction (XRD), Atomic Force microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and thermal analysis (TG, DSC). The samples treated with HAp present a more uniform distribution of the consolidation product and homogeneous infilling of the matrix voids, and induced a slow white colour of the treated surface. For the analyzed samples, the compressive strength determined with Silver-Schmidt Hammer, indicated a compressive strength of 25.33 MPa, an increased values by comparison with the non-treated one (20 MPa). Undoubtedly, this is caused by the network of hydroxyapatite, which can bind weathered stone blocks together providing a substantial reinforcement. The present work is devoted to represent a case study in order to evaluate the application of nanomaterials to conservation of some monument stone.

Fig. 1. Chalk stone non-treated (left) and treated with HAp (right)

Selective references:

1. D. Ţurcanu-Caruțiu, R. M. Ion, *Pre-Restoration Investigations Of The Basarabi Chalk Monument Diagnosis, Treatment And Implications*, European Scientific Institute, 2014, 3, p.124-134.
2. R.M Ion, R.C Fierascu, I. Fierascu, R.M Senin, M.L Ion, M. Leahu, D. Turcanu-Carutiu - *Influence of Fântâniţa Lake (Chalk Lake) Water on the Degradation of Basarabi–Murfatlar Churches*, Engineering Geology for Society and Territory, Springer Ed., 8, 2015, p. 543-546

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