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Analytical Characterization of TiO2-Based Nanocoatings for the Protection and Preservation of Architectural Calcareous Stone Monuments

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Abstract : Historical stone surfaces and architectural heritage especially which located in open areas may undergo unwanted changes due to the exposure to many physical and chemical deterioration factors, air pollution, soluble salts, Rh/temperature, and biodeterioration are the main causes of decay of stone building materials. The development and application of self-cleaning treatments on historical and architectural stone surfaces could be a significant improvement in conservation, protection, and maintenance of cultural heritage. In this paper, nanometric titanium dioxide has become a promising photocatalytic material owing to its ability to catalyze the complete degradation of many organic contaminants and represent an appealing way to create self-cleaning surfaces, thus limiting maintenance costs, and to promote the degradation of polluting agents. The obtained nano-TiO2 coatings were applied on travertine (Marble and limestone often used in historical and monumental buildings). The efficacy of the treatments has been evaluated after coating and artificial thermal aging, through capillary water absorption, Ultraviolet-light exposure to evaluate photo-induced and the hydrophobic effects of the coated surface, while the surface morphology before and after treatment was examined by scanning electron microscopy (SEM). The changes of molecular structure occurring in treated samples were spectroscopy studied by FTIR-ATR, and Colorimetric measurements have been performed to evaluate the optical appearance. All the results get together with the apparent effect that coated TiO2 nanoparticles is an innovative method, which enhanced the durability of stone surfaces toward UV aging, improved their resistance to relative humidity and temperature, self-cleaning photo-induced effects are well evident, and no alteration of the original features.

Keywords : architectural calcareous stone monuments, coating, photocatalysis TiO2, self-cleaning, thermal aging
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