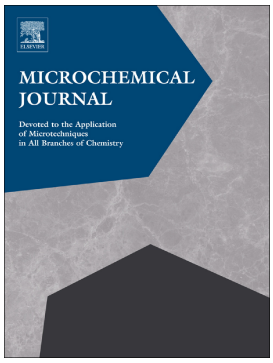

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Enhanced self-cleaning properties of N-doped TiO_2 coating for Cultural Heritage

[1]L. Bergamonti, [2]G. Predieri, [3]Y. Paz, [4]L. Fornasini, [4]P.P. Lottici, [1]F. Bondioli

[1] Department of Industrial Engineering, University of Parma, Parco Area delle Scienze 181/a, 43124 Parma, Italy
[2] Department of Chemistry, University of Parma, Parco Area delle Scienze 17/a, 43124 Parma, Italy
[3] Department of Chemical Engineering, Technion-Israel Institute of Technology, 32000 Haifa, Israel
[4] Department of Physics and Earth Sciences, University of Parma, Parco Area delle Scienze 7/a, 43124 Parma, Italy

Abstract

Nanostructured TiO_2 is the most widely studied photocatalytic material and is used in self-cleaning coatings in buildings and for Cultural Heritage applications. To extend the photocatalytic activity of nanocrystalline titania into the visible spectral range, doping of titania by non-metal elements as N, C, F and S is currently widely investigated. Here we report tests on carbonatic *Travertine* stones coated with two self-cleaning coatings based on N-doped TiO_2 nanoparticles. The two coatings, both obtained by sol-gel synthesis, differ by their titanium precursors and nitrogen sources. The obtained nanoparticles were characterized by X-ray diffraction, UV-VIS absorption, Raman and X-ray photoelectron spectroscopies. The harmlessness of the coatings is demonstrated by colorimetric analysis and by capillary absorption measurements. The self-cleaning properties of the treated stones were evaluated by the measurement of water contact angle and of organic dyes degradation as a function of UV-VIS light irradiation time. The results confirm that the synthesized nanoparticles were successfully doped with nitrogen, allowing a photocatalytic activity, even in the visible range, comparable or better than that shown by P25 Evonik commercial product. A comparison between coating where the dopants are introduced by an acidic process and coating doped using urea as the nitrogen source revealed higher activity for the former. The importance of the nature of the dye in the evaluation of the self cleaning properties is discussed.

Keywords: photocatalytic TiO_2; self-cleaning; Travertine; sol-gel; N-doped TiO_2