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The influence of Nd3+ doping on the physical and photocatalytic properties of nanostructured titania thin films

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The attractiveness of TiO2 – as a photocatalyst for the degradation of organic contaminants from waste water and reduction in air pollutants is due to its high physical and chemical stability, high catalytic activity, high oxidative power and ease of production. More recently, rare-earth metals such as Nd have shown tremendous potential as dopants not only in red-shifting the light absorption, but also in improving the photocatalysis of TiO2. In this work, pure and Nd3+ doped titanium dioxide thin films (~1 - 2 microns) were deposited on quartz, silicon and stainless steel substrates by radio frequency (RF) co-sputtering of TiO2 and Nd metallic targets in an argon atmosphere. Films were prepared by varying process parameters in order to have different Nd concentration in the matrix and the post deposition annealing of the films were made in ambient air conditions. Film properties were studied by X- ray diffraction, Auger electron spectroscopy and X-ray fluorescence. Optical characterizations of the films were carried out using UV- visible near IR spectrophotometry. The photocatalytic activity has been observed by measuring the change in absorption of an aqueous solution methylene blue (MB) dye while the samples were irradiated by UV (254 nm and 352 nm) and visible light. The photocatalytic activity has been expressed as the number of MB molecules oxidized for a given photon flux for each excitation wavelength. A correlation between both the phase structure of the matrix and the Nd3+ concentrations and the photocatalytic properties was searched.

Keywords
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