Abstract

In the present work titanium dioxide (TiO2) thin films were grown by d.c. reactive magnetron sputtering process, systematically varying the Ar/O2 ratio in the gas mixture, in order to study the influence of the oxygen partial pressure on the crystallographic structure and photocatalytic activity of the TiO2 thin films. After the sputtering process the TiO2 coatings were nitrided in a microwave (f= 2.45 GHz) Electron Cyclotron Resonance (ECR) plasma discharge in pure nitrogen, to compare the photocatalytic activity of undoped and nitrogen-doped TiO2 thin films. The crystal structure of the TiO2 grown samples was studied by x-ray diffraction (XRD) and the presence of the anatase phase in these films were corroborated by Raman spectroscopy. On the other hand, X-ray photoelectron spectroscopy (XPS) measurements carried out in the nitrogen-doped TiO2 samples, showed that the nitrogen was incorporated to the films with an average concentration of 18 at% of N. The UV-Vis optical spectroscopy allowed calculating the band gap. A narrowing of the optical band gap from 3.2 eV for the undoped films to 2.5 eV for the N-doped films was observed. Photocatalytic activity tests were done using a methylene blue (MB) dye solution. The irradiation of the films in the MB dye solution was carried out with an emission lamp in the UV and in the visible range for undoped and N-doped TiO2 films, respectively. The results showed that the N-doped TiO2 films had a higher photocatalytic activity in the visible range, reaching a greater MB degradation in comparison with undoped samples, which were subjected to a higher energy radiation.

Keywords

Titanium dioxide, Photocatalytic activity, Magnetron sputtering.