Investigation of Surface Microstructural, Optical and Photocatalytic Activity of Tungsten Doped Titanium Dioxide Thin Films Deposited by Spray Pyrolysis

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Abstract

In the present study, un-doped titanium dioxide (TiO_2) and tungsten (W) doped TiO_2 thin films have been deposited onto plain glass substrates at 450 °C using the spray pyrolysis method. The surface morphology, structural parameters, optical properties and photocatalytic activity of un-doped TiO_2 and W doped TiO_2 thin films doping with concentrations of 0, 2, 4, 6, and 8 at.% were investigated. The FESEM showed several forms of surface morphology of un-doped TiO_2 and W doped TiO_2 thin films. Grain size and diameter of reticulated nanofiber (0.88 to 1.80 μm and 0.267 to 0.187 μm) were observed from the images of FESEM. EDX confirms the presence of Ti, W and O. XRD spectra shows the anatase (tetragonal structure) phase in the un-doped TiO_2 and W doped TiO_2 thin films, with crystallite sizes ranging from 18 to 36 nm. The optical band gap was calculated from the UV-Vis spectra and found for un-doped TiO_2 is 3.34 eV and for 2, 4, 6 and 8 at.% W doped TiO_2 thin films are 3.27, 3.24, 3.18 and 3.05 eV, respectively. The photocatalytic activity was evaluated by the degradation of methylene blue (MB) using UV light. The synergistic impact of the lower band gap and the low recombination rate might be ascribed to it. The photocatalytic activities revealed that the 6 at.% W doped TiO_2 thin films exhibit 76% degradation efficiency.