ABSTRACT

TiO2 thin films were successfully prepared by dip-coating method. The prepared sols were obtained through the hydrolysis of tetraethyl-orthotitanate Ti(OC2H5) 4under controlled pH by two different acids HNO3 and HCl. The effect aging time of the starting solution on the photocatalytic degradation of methylene blue (MB) was studied. The degradation of MB dissolved in water and optical properties are followed by spectroscopy. Structure and microstructure of films have been determined by X-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM). Further investigation of the surface electrical change distribution and chemistry is investigated by advanced scanning kelvin probe measurements. Rietveld analysis reveals the formation of single pure nanocrystalline anatase phase, i.e. 16 nm. SEM and AFM analyses reveal smooth surfaces with a positive surface skewness but with very high surface kurtosis of the HNO3–TiO2 film (1.9) compared to the HCl–TiO2 film (0.065). This was confirmed by the peakedness of its surface, which could influence surface wettability and enhances its photocatalytic degradation properties. Optical measurements show a higher transparency for HNO3/TiO2 compared to HCl/TiO2, 80 and 40%, respectively with an energy bandgap around 3.25–3.30 eV. The results show a stable photocatalytic activity of 80% for thin films prepared by HNO3 independently of time of the aging solution, while the films prepared by HCl show a much lower photocatalytic activity of 40%, which increases by increasing the aging time. The unique nanostructure and surface texture as well as its surface potential are the main factors for obtaining the above promising photocatalytic results