Thickness dependence of rf-magnetron sputter deposited TiO_2 thin films on photocatalytic activity

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TiO_2 as a photocatalyst have been extensively studied due to its application in the development of environmentally harmonious, sustainable and energy-efficient technology as well as its superior properties such as optical and electronic properties, photoactivity, high chemical stability, low cost, nontoxicity[1,2]. Radio frequency (rf) magnetron sputtering have been one of the preferred methods for synthesizing TiO_2 thin films due to good thickness uniformity of the deposited layer over a large area, high adhesion, and reproducibility. We in the present study have systematically investigated factors affecting photocatalytic activity of prepared TiO_2 thin films. TiO_2 thin films of different thicknesses were deposited on a quartz substrate using radio frequency (rf) magnetron sputtering by changing the deposition time from 1 hour, 2 hour and 4 hour respectively. Figure 1 shows the X-ray diffraction (XRD) and photocatalysis studies of prepared TiO2 thin films of various deposition times. The anatase phase of TiO2 in all the films is confirmed by XRD measurements. Further photocatalysis studies show that the photocatalytic activity of prepared TiO_2 thin films increases with thickness. Ti interstitial and oxygen vacancy defects are dominant in 115 nm thick film. With the increase in the thickness surface defect states start to appear and density of these surface defect states increases with an increase in thickness. All observed results of our samples suggest that the dominant factors that affect the photocatalytic activity are not the surface area or bandgaps but the surface or bulk defect states.

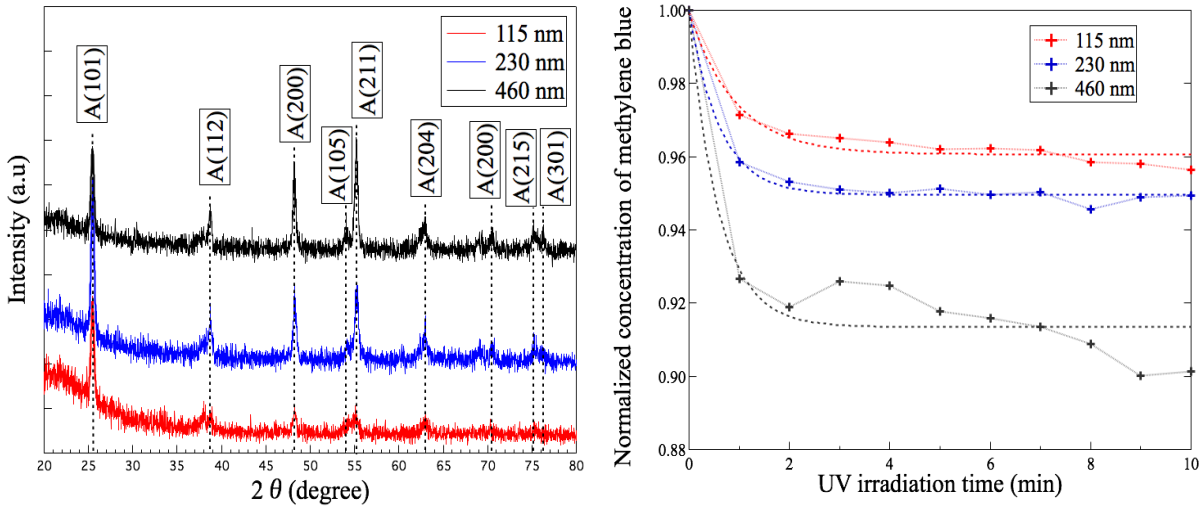

Fig.1: XRD patterns and photocatalysis studies of prepared TiO2 thin films of various thicknesses

References:

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