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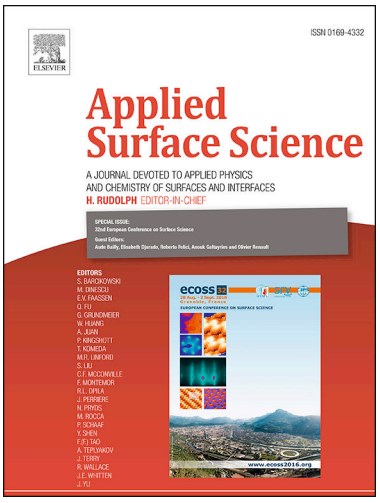

Full Length Article

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Dopant controlled photoinduced hydrophilicity and photocatalytic activity of SnO_2 thin films

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Abstract

The influence of Fe and Ni (1wt. %) doping on the wettability and photocatalytic activity of sol-gel derived SnO_2 films is reported. X-ray diffraction studies revealed the presence of tetragonal phase for both pure and doped SnO_2 thin films. The crystallite size was of the order of 8 nm indicating the nanocrystalline nature of the films. The pure SnO_2 films which were hydrophilic with a contact angle of 11.8^o showed increase in contact angle with doping (38.7^o for Fe and 48.6^o for Ni). This is accompanied by decrease in surface energy and root mean square roughness, with doping of SnO_2 film. In order to further increase the water contact angle, the film surfaces were modified using a layer of stearic acid. As a consequence, the water contact angles increased to 108^o, 110^o and 111^o for the pure, Fe and Ni doped SnO_2 films respectively, rendering them hydrophobic. Significantly, the unmodified surfaces that did not exhibit any change under UV irradiation showed photoinduced hydrophilicity on modification with stearic acid. There was a red-shift in the optical band gap of SnO_2 films from 3.8 to 3.5 eV with doping, indicating the possibility of dopant controlled photocatalytic activity. This was confirmed by observing the photocatalytic degradation of an aqueous solution of methylene blue under UV irradiation. There was, indeed, significant improvement in the photocatalytic efficiency of the metal doped SnO_2 thin film in comparison to undoped film. The current work, thus, demonstrates a simple method to chemically engineer the wettability and photocatalytic activity of SnO_2 thin film surfaces.

Key words: Self-cleaning, Surface energy, Contact angle, Photocatalytic activity.