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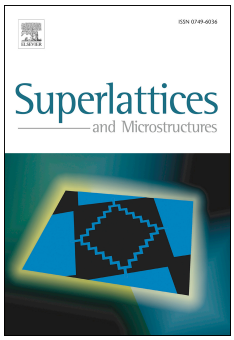

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Analysis of the photocatalytic activity of CdS+$ZnTiO_3$ nanocomposite films prepared by sputtering process

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Abstract

$ZnTiO_3$ and CdS+$ZnTiO_3$ nanoparticulate composite films were deposited at room temperature onto glass substrates using the radio frequency sputtering process. The composite films were grown by employing a target prepared with commercial high purity CdS powder and $ZnTiO_3$ nanopowder at CdS/$ZnTiO_3$ ratio of 1/4. Subsequently, annealing of the as-deposited layers was performed at 300 °C and 500 °C in open atmosphere. The samples were characterized by X-ray diffraction, atomic force microscopy, transmission and scanning electron microscopy, and UV–Vis, Raman and photoluminescence spectroscopies. Results show that the zinc titanate nanoparticles in $ZnTiO_3$ and CdS+$ZnTiO_3$ films exhibit mainly cubic phase of $ZnTiO_3$, where the hexagonal phase is also present in a minor proportion. The observed CdS quantum dots grow in hexagonal phase. The photocatalytic activity (PA) was tested by means of the degradation of methylene blue (MB) measurements. The bi-component CdS-$ZnTiO_3$ nanocomposite film annealed at 300 °C exhibits superior MB degradation than CdS+$ZnTiO_3$ annealed at 500 °C and pure $ZnTiO_3$, which is due to an adequate coupling of the energy band gap of both materials. This coupling promotes an efficient separation of photo-generated electron-hole pairs between CdS+$ZnTiO_3$. A discussion about the different PA in the composites studied is included.

Keywords: photocatalytic activity; methylene blue; CdS+ZnTiO3; nanocomposite films; sputtering process.

1. Introduction

Degradation of organic pollutants by heterogeneous photocatalysis continuous, at present, concentrating interest of many researchers, because is a powerful tool for the cleaning of many contaminated liquids and gases with organic substances. Through this method it is possible to carry out the photocatalytic oxidation and reduction of organic pollution causing they reduction to non-toxic solid substances like silicates, carbonates, nitrates, etc. [1] or/and by the degradation to also non-toxic gaseous byproducts [2]. The searching of new