DEVELOPMENT OF TiO_2 AND Bi_2O_3 THIN FILMS BY ULTRASONIC SPRAY PYROLYSIS FOR PHOTOCATALYTIC APPLICATIONS

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The aim of the study was to deposit TiO_2 and Bi_2O_3 thin films by ultrasonic spray pyrolysis and to investigate the influence of the processing variables, including precursor solution composition and the deposition temperature, on the photocatalytic activity. TiO_2 thin films were prepared from titanium(IV) isopropoxide (TTIP) solution at deposition temperature of 350 °C and annealed for 1 h at 500 °C. The composition of precursor solution was optimised by varying the amount of acetylacetone (AcacH) in the solution [1]. Bi_2O_3 thin films were prepared from bismuth(III) acetate solution. The deposition temperature was optimised in the range of 250 - 450 °C and air annealed in the temperature range of 300 - 550 °C [2]. Both materials, TiO_2 and Bi_2O_3 films, were tested for photocatalytic oxidation of methyl orange (MO) dye in aqueous solutions under UV-A and visible light. In addition, TiO_2 activity was studied for oxidizing volatile organic compounds in the gas-phase [3,4].

The photocatalytic activity of TiO_2 thin films was found to increase rapidly with the increase in amount of AcacH in the precursor solution, due to the presence of incorporated carbon, which influenced the electronic structure and charge separation of the films [3]. The photocatalytic activity of Bi_2O_3 films was enhanced by higher amount of hydroxyl groups and carbon species on the surface obtained during the deposition of amorphous film and crystallization during the annealing [2]. The highest degradation of 10 ppm of MO on the TiO_2 thin film after 5 h UV-A irradiation reached 54%, while the highest degradation on the Bi_2O_3 film reached 48%.

References

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