



SYNTHESIS AND PHOTOCATALYTIC PROPERTIES OF MODIFIED TiO₂ NANOPORES AND NANOTUBES

R. Drunka, J. Grabis

*Institute of Inorganic Chemistry
Riga Technical University
Miera str. 34, LV-2169 Salaspils – Latvia*

A. Patmalnieks

*Institute of Microbiology and Biotechnology
University of Latvia
Kronvalda str. 4, LV-1586 Riga – Latvia*

ABSTRACT

Titanium dioxide is very promising material for photocatalyse, degradation of organic compounds, splitting of water, for manufacture self-cleaning materials and dye- sensitized solar cells. It is generally concluded that the photocatalytic activity depends on the specific surface area, degree of crystallization of the titania particles, phase composition and presence of dopants, which promotes absorption of visible light.

Self-organized TiO₂ nanotube-layers were formed by electrochemical anodization of titania foil in a (NH₄)₂SO₄/HF electrolyte. Doped with sulfur nanotubes and nanopores were prepared by their treatment at 380⁰C in H₂S flow or by using method of micro arc oxidation in sulfur containing electrolyte. Doped with nitrogen nanotubes were obtained by their treatment at 500 ⁰C per 2h in N₂ flow. Doped with tungsten oxide nanotubes were prepared by anodization of TiO₂ foil mechanically rubbed with tungsten particles or by additional anodization of the as-prepared TiO₂ nanotubes in peroxotungstic acid sol and ethanol-water electrolyte.

The catalytic activity was determined by degradation of MB solution under UV and visible light illumination. The photocatalytic activity of the prepared TiO₂ nanotubes depends on the preparation conditions, the presence of WO₃, S and N increases their activity. During illumination the degradation of MB reaches 85–90% depending on applied dopants. The prepared photocatalysts have higher activity with respect to pure TiO₂ nanotubes. Sulfur doped nanotubes have higher activity with respect to nitrogen and WO₃ doped nanotubes.

Keywords: titania nanotubes, sulfur, nitrogen, tungsten oxide dopants, methylene blue decomposition