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Influence of deposition conditions on properties of ZnO films for photocatalytic application
Ispitivanje uvjeta nanošenja na svojstva ZnO slojeva za fotokatalitičku namjenu

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ZnO is a semiconducting material with energy gap of 3.2 eV, capable of absorbing UV light. Due to easy and inexpensive synthesis and low environmental impact, ZnO is attractive for use in photovoltaic cells and as a photocatalyst for degradation of organic pollutants [1]. We have prepared ZnO films on a glass substrate from a solution of zinc acetate in methanol, using dip-coating and chemical bath deposition methods. Influence of calcination on transformation of initial acetates to ZnO was studied by combined differential scanning calorimetry and thermogravimetric analysis, infrared spectroscopy (FTIR) and X-ray diffraction (XRD), while the morphology was investigated by scanning electron microscopy. Photocatalytic activity of selected films was investigated by following the decomposition of 2,5-dihydroxybenzoic acid exposed to UV-A light in a laminar-flow reactor. Concentration of the acid was determined using a UV-Vis spectrophotometer.

Dip-coating results in a crystalline zinc acetate film on the glass substrate, which is converted into pure crystalline ZnO upon calcining at temperatures above 300 °C. Chemical bath deposition results in mostly amorphous structure with pronounced layered regularity, as evidenced by XRD, and FTIR spectra indicate that it is probably a mixed zinc acetate hydroxide [2]. This compound also transforms into pure ZnO above 300 °C. Two methods give films of very different morphology. Films prepared by dip-coating are smooth and consist of fine ZnO grains, while those prepared by chemical bath deposition consist of leafy layers of ZnO grains. This morphology is formed during deposition and conserved during calcining. Expectations that leafy morphology is more suited for photocatalytic applications [3] was confirmed by photocatalytic investigations, which have shown that the film prepared by chemical bath deposition degrades 2,5-dihydroxybenzoic acid more quickly than those prepared by dip-coating. Further research is needed to optimize the deposition conditions.

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