Changing Optical and Structural Properties of Nanolayer Zinc Oxide Doping with Manganese with Physical Parameters

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Received: 24.07.2018 Final revised: 10.05.2019 Accepted: 07.07.2019

Abstract

Pure and Mn-doped ZnO nanofilms were prepared onto glass substrates using the sol-gel method, and optical properties of pure and ZnO:Mn were investigated with regard to different thicknesses, different annealing temperatures, and effects of layers. According to our results, increasing the thickness and annealing temperature decreases the measured transmittance spectrum. XRD spectrum shows that the crystal structures are formed at high annealing temperatures. The band gap energy of nanofilms decreases with increasing the annealing temperature (3.45 eV-3.84 eV) and thickness of the nanofilms (3.38 eV-3.41 eV). This increase is due to the improvement in the crystal quality owing to the increase in annealing and the thickness of the nanofilms. The influence of four different solvents that were used in the samples, was also investigated. The results of calculating the band gap show that the sample prepared with methanol has the highest energy gap and the smallest grain size. This solvent has also the highest transmittance. Samples prepared with ethanol and 1-butanol have the most penetration depth. The gas-sensing performance of ZnO depends on the grain size, so using methanol on ZnO can be utilized in gas sensor devices for more precise results.

Keywords: zinc oxide, sol-gel, nanofilm, doping, thickness, temperature

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