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Title: Characterization of p-NiO/n-Si heterojunctions prepared by spin coating method

Abstract
NiO presents interest for a wide range of optoelectronic application as a p-type transparent conducting films due to the wide band gap (3.6–4.0 eV) [1]. Furthermore, its excellent durability and electrochemical stability is important for optical applications. NiO thin films have been fabricated by various physical and chemical deposition techniques, such as magnetron sputtering [5], spray pyrolysis [2,4], spin-coating [3] and by electrochemical anodic deposition. Spin-coating method is an easy, low cost, safe, cheap, and non-vacuum technique for preparing transparent conducting oxide films with high performance parameters as compared to the other techniques.
In this paper, we present results on preparation of NiO thin films by spin-coating method. The films have been deposited on n-Si (100) substrates from 0.35 M aqueous solution of nickel chloride - $NiCl_2*6H_2O$ or nickel acetate - $Ni(ac)_2*4H_2O$ dissolved in 20 mL of 2-methoxyethanol + 0.5 mL of diethanolamine (DEA) as a stabilizer. The substrates were chemically and ultrasonically cleaned before coating, and the films have been deposited at a rotational speed of 2000-3000 rpm, to spread the coating material over the entire surface of the substrate by centrifugal force. Each film was deposited in a number of cycles, consisting of a 20 seconds deposition process followed by drying at 150°C for 10 minutes. The film thickness is determined by the number of the applied cycles. When the desired film thickness was reached, it was treated at 500 °C for one hour in the air. The structural, morphological, optical and electrical parameters of films were investigated in detail by means of scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), current–voltage characterization (I-V), photoluminescence and the optical absorption. Ag contacts have been deposited on p-NiO films for electrical characterization. The I-V characteristics of p-NiO/n-Si heterojunctions demonstrated photosensitivity in the UV spectral range, with a current increase from 10^{-6}A in the dark to 10^{-5}A under UV illumination with a power density of 100 mW/cm^2 from a solar simulator. The analysis of optical absorption spectra plotted in $(\alpha h\upsilon)^2 = f(h\upsilon)$ coordinates for films deposited on silica substrates revealed a direct bandgap value of around 3.66 eV for p-NiO films.

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