



Effect of solution molarity on the structural, optical, electrical and photo-response properties of SILAR-deposited ZnO films

Swati M. Pujar¹, Sahana Moger¹, Gowrish K. Rao^{1*} , M. G. Mahesha¹, and Ashwath Kotal¹

¹Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka 576104, India

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ABSTRACT

Cost effective SILAR method was employed to deposit ZnO thin films on glass substrates for thin film UV photodetector applications. The dependence of the film properties such as structure, morphology, optical and electrical properties on the cationic precursor molarity is investigated in detail. When the solution molarity was increased from 0.1 M to 0.2 M, the crystallite size was found to increase by 270%. It was noted that the films had nearly stoichiometric composition. The SEM images revealed the presence of rod or needle-like structures in the films. The optical energy band gap of the films is slightly modified while the PL spectra showed reduced defect states and enhanced UV emission at higher molarities. The samples responded strongly to wavelengths in the near ultraviolet region. A 1400 times increase was observed in the current upon the UV illumination. The films exhibited persistent photocurrent.

1 Introduction

Currently, many wide bandgap thin film photodetectors are being extensively investigated due to their relatively superior spectral response characteristics in the UV region. Among them, Zinc Oxide (ZnO) seems to be one of the most promising candidates as it has the potential to replace other expensive wide bandgap semiconductor photodetectors such as GaN due to its low-cost of synthesis and simpler fabrication technology. The wide band gap of ZnO enables it to operate effectively in the UV region besides having

large transparency in the visible region. [1, 2] Apart from this, it shows several distinctive properties such as large exciton binding energy of 60 meV, which is higher than most other semiconductors. Being very abundant in nature, ZnO is a relatively low-cost material that can be deposited using simple deposition methods. It is a non-toxic and eco-friendly material with high electron mobility and good thermal and chemical stability [1–4].

However, ZnO also exhibits a well-known phenomenon called persistent photoconductivity (PPC). When energy of the incident photons exceeds the

*Address correspondence to E-mail: kgowrishrao@gmail.com; gk.rao@manipal.edu

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