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ZnO thin films based interdigitated ultraviolet photodetectors with metal embedded microparticles

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Abstract

This paper reports the characterization of ZnO-based interdigitated metal–semiconductor–metal (MSM) UV photodetectors fabricated by two methods. Specifically, devices having Al or Ni contacts based on Al or Ni microparticles embedded ZnO films, respectively. ZnO films were grown on *p*-type Si <100> substrates by the sol-gel method, Al or Ni microparticles where first grown on the on substrates by thermal evaporation using a 90 μm mesh shadow mask. We have estimated the photocurrent, contrast ratio, responsivity, and quantum efficiency of the photodetectors for applied voltage from -5 to 5 V and optical power from 50 to 200 μW at 365 nm. The current–voltage characteristics were studied and parameters such as ideality factor, leakage current, and barrier height of the contacts were extracted. The barrier height dependence on the electric field and tunneling through the barrier has been taken into account of the studied MSM devices. The bandgap of ZnO and is evaluated from the absorbance spectra via double beam spectrophotometry. All devices showed a maximum photo-response at flat band voltages of MSMs. The study also revealed that the Ni microparticles embedded ZnO film resulted in devices exhibiting better photoresponse as compared to those using Al microparticles embedded ZnO thin films.

Biography

Ghusoon Mohsin Ali received the B. Eng. (Tech.) and M. Eng. (Tech.) degrees in electrical engineering from University of Technology, Baghdad-Iraq, in 1984 and 1989, respectively, and the Ph.D. degree in electronics engineering from the Indian Institute of Technology (IIT), Banaras Hindu University, Varanasi India, in 2011. She is working as a lecturer with the Electrical Engineering Department, College of Engineering, Al-Mustasiriyah University, Baghdad-Iraq. She has published 25 research papers in leading technical journals and in Conference Proceedings. She has also worked as a principal investigator in many sponsored projects. She is a recipient of Iraq-Science-Fellowship-Program (ISFP) at Coastal Carolina University, SC, USA. Her research interests include nanostructure film based electronic and optoelectronic devices.