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Properties of ZnO nanowire based UV detectors

John Zeller
University of Connecticut, USA

Abstract

Zinc oxide (ZnO) nanostructures are biocompatible and versatile functional materials having a bandgap of 3.37 eV that exhibit both semiconducting and piezoelectric properties with a diverse group of growth morphologies. Highly ordered vertical arrays of ZnO nanowires (NWs) were grown on p-Si substrates using metalorganic chemical vapor deposition (MOCVD). Photoluminescence (PL) data of the grown NWs show near band edge ultraviolet (UV) peaks with a sharp peak at 388.5 nm (3.19 eV). The sharp PL results indicate the presence of fewer oxygen defects and consequently fewer traps in the NW arrays than that which has been reported in literature.

In addition, photo response measurements of the ZnO NW arrays were performed utilizing UV sources in the ~250-370 nm wavelength range. I-V characteristics under UV exposure over applied biases ranging from -5 to 5 V suggest significant wavelength dependence in the mentioned wavelength range when compared with the dark current. Furthermore, when UV radiation incident on the detector surface was turned on and off at fixed intervals, photo response as a function of switching time with relatively fast measured switching speeds (~15 s) between low and high conductivity states for this type of device was observed. These results indicate that ZnO NW based devices are well-suited for detection of UV wavelengths, for applications potentially including missile warning and gas sensing.

Biography

John Zeller received B.S. degree with honors in electrical engineering from Trinity College, Hartford, CT, in 2002. He received M.S. and Ph.D. degrees in electrical engineering from the University of Connecticut in 2007. After graduation he began a postdoctoral fellowship the Naval Undersea Warfare Center (NUWC), Newport, RI. Dr. Zeller joined Magnolia Optical Technologies in 2011, and is primarily involved in the development of ZnO nanowire arrays for UV sensor applications.