HETEROJUNCTION BASED ON BORON DOPED DIAMOND AND ZNO THIN FILMS

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Abstract

Diamond and ZnO are very promising wide-bandgap materials for electronic, photovoltaic and sensor applications because of their excellent electrical, optical, physical and electrochemical properties and biocompatibility. In this contribution we show that combining of these two materials opens up the potential for fabrication of bipolar heterojunctions. Semiconducting boron doped diamond (BDD) thin films were grown by HFCVD method with various boron concentration in the gas mixture on Si and UV grade silica glass substrates. Doped zinc oxide (ZnO:Al, ZnO:Ge) thin layers were deposited by diode and PLD sputtering as the second semiconducting layer. The amount of dopants within the films was changed to obtain optimal semiconducting properties to form a bipolar p-n junction. Finally, different BDD/ZnO heterostructures were prepared and analyzed. Raman spectroscopy, SEM, Hall constant and I-V measurements were used to estimate the quality, structural and electrical properties of deposited heterostructures, respectively. I-V measurements have shown a rectifying ratio of 55 at ±4 V. We found that only very low dopant concentrations of both used semiconducting crystalline materials enabled us to create functional p-n junction. Obtained results indicate a promising potential to enable the production of transparent BDD/ZnO bipolar heterojunction.

Keywords: Boron doped diamond, zinc oxide, Raman spectroscopy, bipolar heterostructure

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