Optoelectronic properties of PA-MBE ZnO-based heterojunctions

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Recently, the branch of physics including ultraviolet light detectors has developed very fast due to technology progress and increasing number of possible applications of such devices. New materials and structures have been introduced, employing wide band gap semiconductors, which possess intrinsic "blindness" to visible light. One of the proposed materials is zinc oxide – a semiconductor with direct wide band gap of 3.3 eV, which can be further widen by adding magnesium oxide (7.8 eV) to the compound. This procedure is often used and allows to shift the wavelength cut-off edge to shorter wavelengths range.

During our work, two p-Si/n-ZnMgO structures were investigated in order to characterize their properties in terms of their applicability in ultraviolet detectors. Therefore a few experimental techniques have been applied: current-voltage (I-V) characteristics, photoluminescence (PL) and photoresponsivity measurements. I-V characteristics measurements were carried out at 310 K and provided information about basic parameters describing p-n junctions, which indicated rectifying properties of both structures. PL and photoresponsivity spectra were measured at room temperature. Beside the peaks corresponding to near-bandgap transitions, the emission bands associated with defects were noticed in one of the measured PL spectra. The photoresponse characteristics were thoroughly examined - both structures exhibit absorption of the UV light in the ZnMgO layer. However, the junctions possess some important disadvantages, which were presented together with possible solutions to appearing problems. Employing those results can lead to obtaining a well-working UV detectors.

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