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Ultraviolet photoconductive sensor based on single ZnO nanowire

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ZnO nanowires were synthesized by the CVD procedure and have been investigated by SEM, TEM, SAED, Raman, and cw PL spectroscopy. The fabrication of an ultraviolet (UV) photoconductive detector based on single ZnO nanowire (100 nm in diameter) is presented. This nanostructure detector is prepared in a FIB/SEM set-up by using nanodeposition for metal electrodes. The photoresponse of the UV sensor are studied using a UV source with an incident peak wavelength of 365 nm. It was demonstrated that the output signal of the sensors is reproducible under UV irradiation. The photoresponse and characteristics of the ZnO nanowiredevice demonstrates that focused ion beam process offers a way to fabricate novel nanodevices on a single ZnO nanowire with diameters as small as 100 nm. The presented single ZnO nanowire sensor proves to be promising for application in various processes.

1 Introduction Recently, wide-gap semiconducting oxide micro- and nanostructures based on ZnO, SnO_2, TiO_2 have attracted tremendous research interest due to their ultraviolet (UV) photoresponse and their optical transparency in the visible spectral range [1–9]. In particular, quasi-one-dimensional (Q1D) ZnO nanowires/nanorods are promising as a new type of low-cost and high-speed UV nanoscale photoconductive detectors and optical switches [1, 2, 6, 7, 9]. The low dimensions of such nanostructures promise increase in electronic device packing density, low power consumption, and also enhanced UV sensing properties. Q1D nanostructures with small diameters (<100 nm) exhibit a large surface-to-volume ratio which makes them highly susceptible to altered electrical properties by means of electron–hole generation or recombination during UV exposure.

UV detection with nanowires is normally realized by monitoring the current–voltage or the electrical conductance variation when exposed to UV radiation. Due to the unique geometry of nanowires the active volume contributing to dark current (as a source of noise) is one thousandth of a normal size detector. This allows one to reach a higher sensitivity by using a single nanowire in devices.

In particular, Yang and co-workers [1] used electron-beam lithography to fabricate nanowire-based UV