Graphite/ZnO nanorods junction for ultraviolet photodetectors

Roman Yatskiv, Maria Verde, Jan Grym

Institute of Photonics and Electronics, Chaberska 57, Prague, Czech Republic
yatskiv@ufe.cz

Abstract
Zinc oxide is a well-known material which has been widely used for optoelectronic applications, due to its direct wide bandgap (E_g 3.3 eV at 300 K), large exciton binding energy (~60 meV), good optical transmittance in the visible region (90%), high optical gain (about three times higher than GaN), and efficient radiative recombination [1]. Moreover, in recent years there has been an increasing interest on ZnO nanostructures for their use as UV photodetectors [2-5].
Here we report a new kind of graphite/ZnO NRs junction photodetector for UV sensing. The graphite/ZnO NRs junctions were prepared by hydrothermal growth and deposition of colloidal graphite. The electrical properties of these junctions were investigated at different temperatures (Fig.1c). It was found that their I-V characteristics can be well described by a tunnel-recombination current transport mechanism via interface states (more information about the preparation of the junctions and a detailed analysis of the transport mechanism were reported in our previous work [6]).
The IV characteristics of the graphite/ZnO NR junctions measured in dark and under UV illumination are presented in Fig. 2. Both reverse and forward currents increased due to the absorption of UV light, which generated electron-pair holes in the depletion region. Due to the built-in electric field of the depletion region, the holes move towards the anode and the electrons move towards the cathode, thus generating photocurrent.
Fig. 3 shows the photocurrent response (of the graphite/ZnO NR junctions) at zero bias voltage. These structures show very fast response times and good reproducibility.

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References

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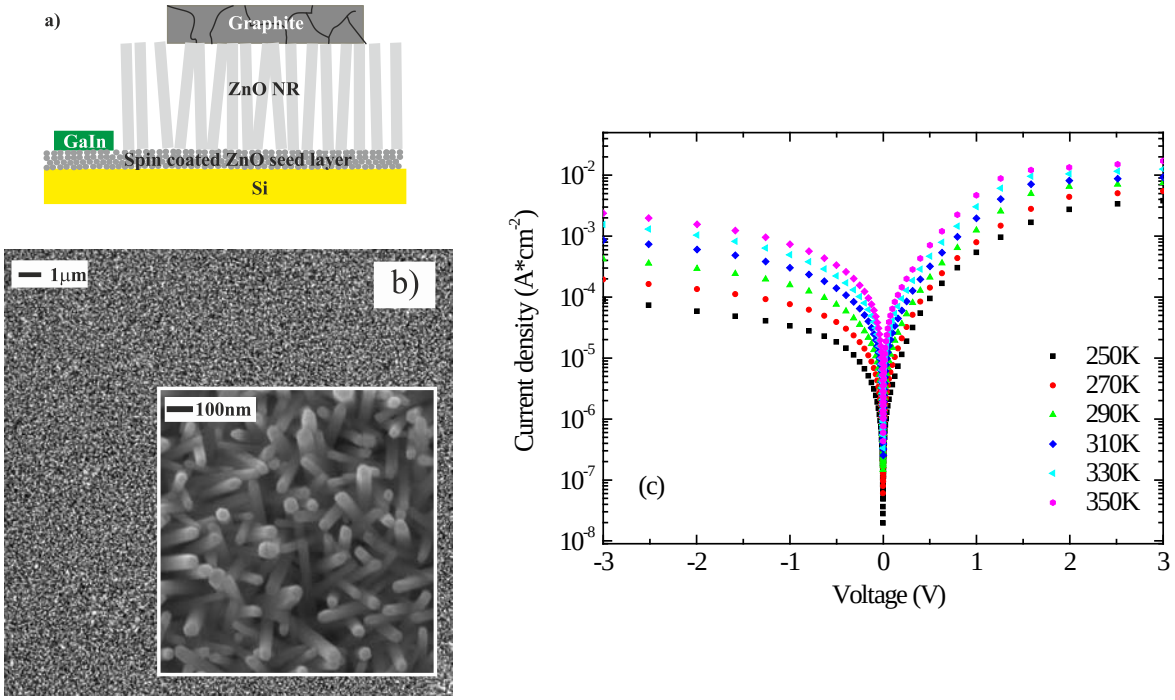

Figure 1 (a) SEM image of the ZnO NRs prepared by hydrothermal growth; (b) schematic cross section of the graphite/ZnO NR junction; (c) current-voltage characteristics of the graphite/ZnO NR junction measured at different temperatures.

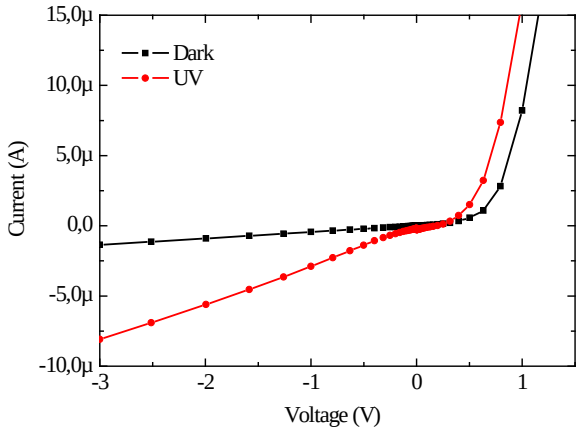

Figure 2 IV characteristics of the graphite/ZnO NRs junction measured at dark and under UV illumination.

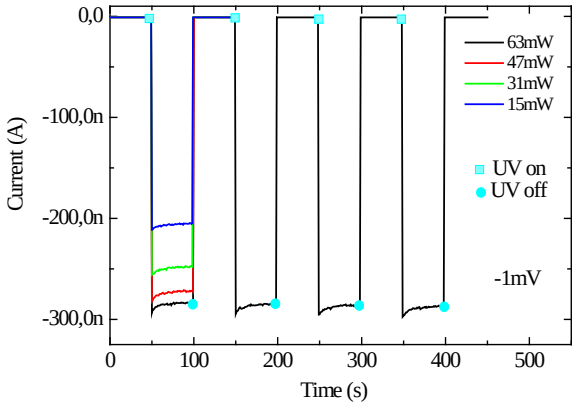

Figure 3 UV on/off photo-response of the graphite/ZnO NRs junction upon illumination with 395 nm light with different luminous intensity.