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Size-dependent UV and gas sensing response of individual Fe_2O_3-ZnO:Fe micro- and nanowire based devices

Jorit Gröttrup, Vasile Postica, Nicolai Ababii, Oleg Lupan, Christiane Zamponi, Dirk Meyners, Yogendra K. Mishra, Victor Sontea, Ion Tiginyanu, Rainer Adelung

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Abstract

In this work, the UV and gas sensing properties of single Fe-doped and Fe2O3-functionalized ZnO micro- and nanowires are reported. The influence of microwire diameter and concentration of Fe2O3 micro- and nanoparticles on the sensing properties of the fabricated devices was investigated. Results clearly reveal that sensors with a higher response can be obtained by a decrease in the diameter of micro- and nanowires and an increase of the Fe2O3 micro- and nanoparticle concentration on the surface of microwires. The enhanced sensing properties can be explained based on excellent charge separation properties of the formed Fe2O3/ZnO heterojunctions in the case of UV response which prolong the photocarrier lifetime and based on excellent catalytic properties of Fe2O3 in the case of gas sensing. The presented results demonstrate the importance of surface functionalization of single ZnO structures with other semiconducting oxide micro- and nanoparticles for the improvement of their sensing properties,

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i.e., UV and ethanol sensing, even for a single wire/rod with micro- and nanometric diameter.