Synthesis of ZnO nanorods by microwave-assisted chemical-bath deposition for highly sensitive self-powered UV detection application

ABSTRACT

High-quality vertically aligned zinc oxide (ZnO) nanorods were successfully grown on seeded silicon substrates p-Si(100) through microwave-assisted chemical bath deposition. Structural and morphological analyses revealed hexagonal wurtzite nanorods perpendicular to the substrate along the c-axis in the direction of the (002) plane. Optical measurements showed a high-intensity UV peak with a low broad visible peak. UV emission was compared with the visible emission having an IUV/Ivis ratio of 53. A metal–semiconductor–metal-based UV detector was then fabricated by depositing two metal contacts onto the ZnO nanorod surfaces. Current–voltage measurements revealed a highly sensitive device with a self-powered characteristic. At zero applied bias, the fabricated device showed a significant difference between the UV current and dark current. The device further showed a sensitivity of 304 × 104 to low-power (1.5 mW/cm2) 365 nm light pulses without an external bias. Photoresponse measurements demonstrated the highly reproducible characteristics of the fabricated UV detector with rapid response and baseline recovery times of 10 ms. This work introduced a simple, low-cost method of fabricating rapid-response, highly photosensitive UV detectors with zero power consumption.

Keyword: ZnO; Nanorods; Microwave CBD; High sensitivity; UV light detector