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Fabrication of ZnO nanorod-based hydrogen gas nanosensor

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Abstract

We report a first work on nanofabrication of hydrogen nanosensor from single ZnO branched nanorods (tripod) using in-situ lift-out technique and performed in the chamber of focused ion beam (FIB) system. Self-assembled ZnO branched nanorod has been grown by a cost-effective and fast synthesis route using an aqueous solution method and rapid thermal processing. Their properties were analyzed by X-ray diffraction, scanning electron microscopy, energy dispersion X-ray spectroscopy, transmission electron microscopy, and micro-Raman spectroscopy. These analyses indicate high quality ZnO nanorods. Furthermore, our synthesis technique permits branched nanorods to be easily transferred to other substrates. This flexibility of substrate choice opens the possibility of using FIB system for handling.

The main advantage of the proposed in-situ approach is a controllable lift-out procedure which permitted us to obtain a 90% success rate for building nanodevices. The fabricated nanosensor uses only single self-assembled ZnO branched nanorod (tripod) to gauge the 150 ppm H_2 in the air at room temperature. The hydrogen sensitivity is in the range of 0.6–2% depending on which two branches to use. The nanosensor has selectivity against other gases such as O_2, CH_4, CO and LPG, which shows sensitivity of <0.02%. The single ZnO branched nanorod sensor can operate at low power of <5μW.