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Article

Enhanced Ethanol Gas Sensing Properties of SnO_2-Core/ZnO-Shell Nanostructures

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Abstract: An inexpensive single-step carbon-assisted thermal evaporation method for the growth of SnO_2-core/ZnO-shell nanostructures is described, and the ethanol sensing properties are presented. The structure and phases of the grown nanostructures are investigated by field-emission scanning electron microscopy (FESEM), transmission electron microscopy (TEM) and X-ray diffraction (XRD) techniques. XRD analysis indicates that the core-shell nanostructures have good crystallinity. At a lower growth duration of 15 min, only SnO_2 nanowires with a rectangular cross-section are observed, while the ZnO shell is observed when the growth time is increased to 30 min. Core-shell hierarchical nanostructures are present for a growth time exceeding 60 min. The growth mechanism for SnO_2-core/ZnO-shell nanowires and hierarchical nanostructures are also discussed. The sensitivity of the synthesized SnO_2-core/ZnO-shell nanostructures towards ethanol sensing is investigated. Results show that the SnO_2-core/ZnO-shell nanostructures deposited at 90 min exhibit enhanced sensitivity to ethanol. The sensitivity of SnO_2-core/ZnO-shell nanostructures towards 20 ppm ethanol gas at 400 °C is about ~5-times that of SnO_2 nanowires. This improvement in ethanol gas response is attributed to high active sensing sites and the synergistic effect of the encapsulation of SnO_2 by ZnO nanostructures.