Supporting Information

Controllable synthesis of ZnO-based core/shell nanorods and core/shell nanotubes

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Experimental Section

A simple three-electrode cell was used in our experiments. The graphite electrode was used as a counter electrode (spectral grade, 1.8 cm^2). The saturated calomel electrode (SCE) was used as the reference electrode that was connected to the cell with a double salt bridge system. The metal (Ti and Cu) plates (99.99 wt%, 1.5 cm^2) were used as the substrates for electrodeposition, and they are prepared complying the following steps before each experiment: firstly polished by SiC abrasive paper from 300 to 800 grits, then dipped in HCl solution (5%) for 5 min and rinsed with acetone in ultrasonic bath for 5 min, and finally washed by distilled water. ZnO nanorods were firstly electrodeposited in solution of 0.01 M $Zn(NO_3)_2$+0.1M NH_4NO_3 by galvanostatic electrolysis for 60 min at 70 ^{0}C. ZnO/Bi_2O_3 core/shell nanorods were synthesized on Ti substrate by the electro-deposition of Bi_2O_3 on the surfaces of ZnO nanorods in solution of 0.01 M $Bi(NO_3)_3$+0.02M

NH_4NO_3 (pH=6.5) by galvanostatic electrolysis with current density of 1.5 mA/cm^2 for 60 min at room temperature. ZnO/PANI core/shell hybrid nanotubes were prepared on Cu substrate by the electrochemical polymerization of PANI on the surfaces of ZnO nanorods in solution of 0.1 M aniline+0.1 M NH_4NO_3 (pH=1) with current density of 0.5 mA/cm^2 for 60 min and synchronously etching of ZnO nanorods under the role of acid.

The synthesized ZnO/Bi_2O_3 core/shell nanorods and ZnO/PANI core/shell nanotubes were characterized by thermal field emission environment scanning electron microscope (TFE-SEM, FEI, Quanta 400), transmission electron microscope (TEM, JEM-2010HR), X-ray diffraction (XRD, PIGAKU, D/MAX 2200 VPC), and X-ray photoelectron spectroscopy (XPS, ESCALAB 250). The electrochemical measurements were carried out in a Chi 660C electrochemical workstation. ZnO/Bi_2O_3 core/shell nanorods were deposited on Ti substrate with a surface area of 1.0 cm^2, and they were studied as electrodes for supercapacitor applications in 1.0 M Na_2SO_4 electrolyte. The graphite sheet was used as a counter electrode and the SCE was used as the reference electrode. The cyclic voltammetry experiments were performed between -0.20 and -1.0 V vs SCE at a scan rate of 5 mV/s. ZnO/PANI core/shell hybrid nanotubes were synthesized on Cu substrate by electrochemical polymerization/etching process. The photoluminescence (PL) measurements of ZnO/PANI core/shell nanotubes were carried out on a fluorescence spectrophotometer at room temperature, and the excited wavelength was 325 nm.

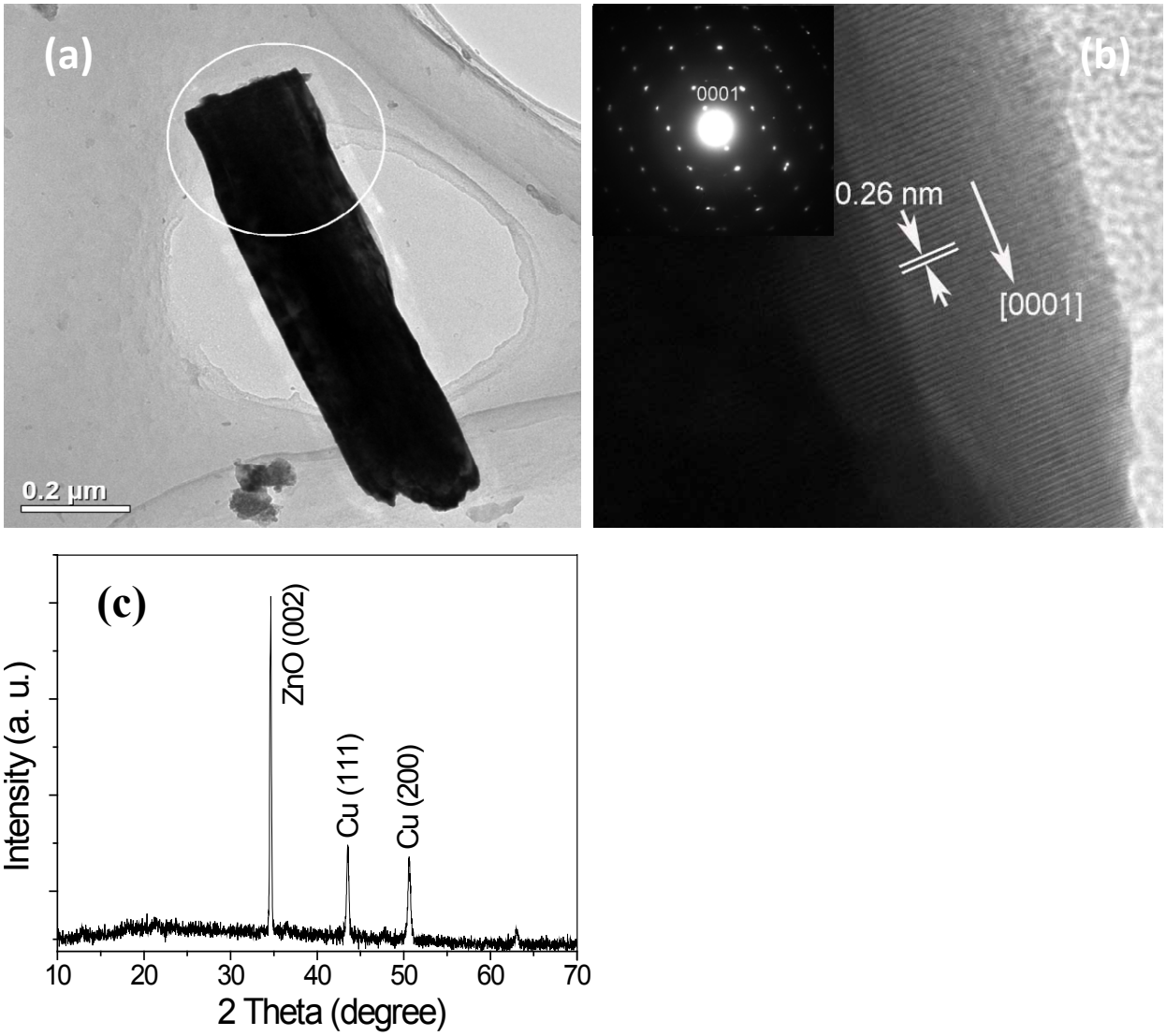

Fig. S1 (a) TEM image, (b) HRTEM image and SAED pattern (inset), (c) XRD pattern of ZnO nanorods deposited in solution of 0.01 M $Zn(NO_3)_2$ with current density of 2.5 mA/cm^2 at 70 ^{0}C for 60 min.

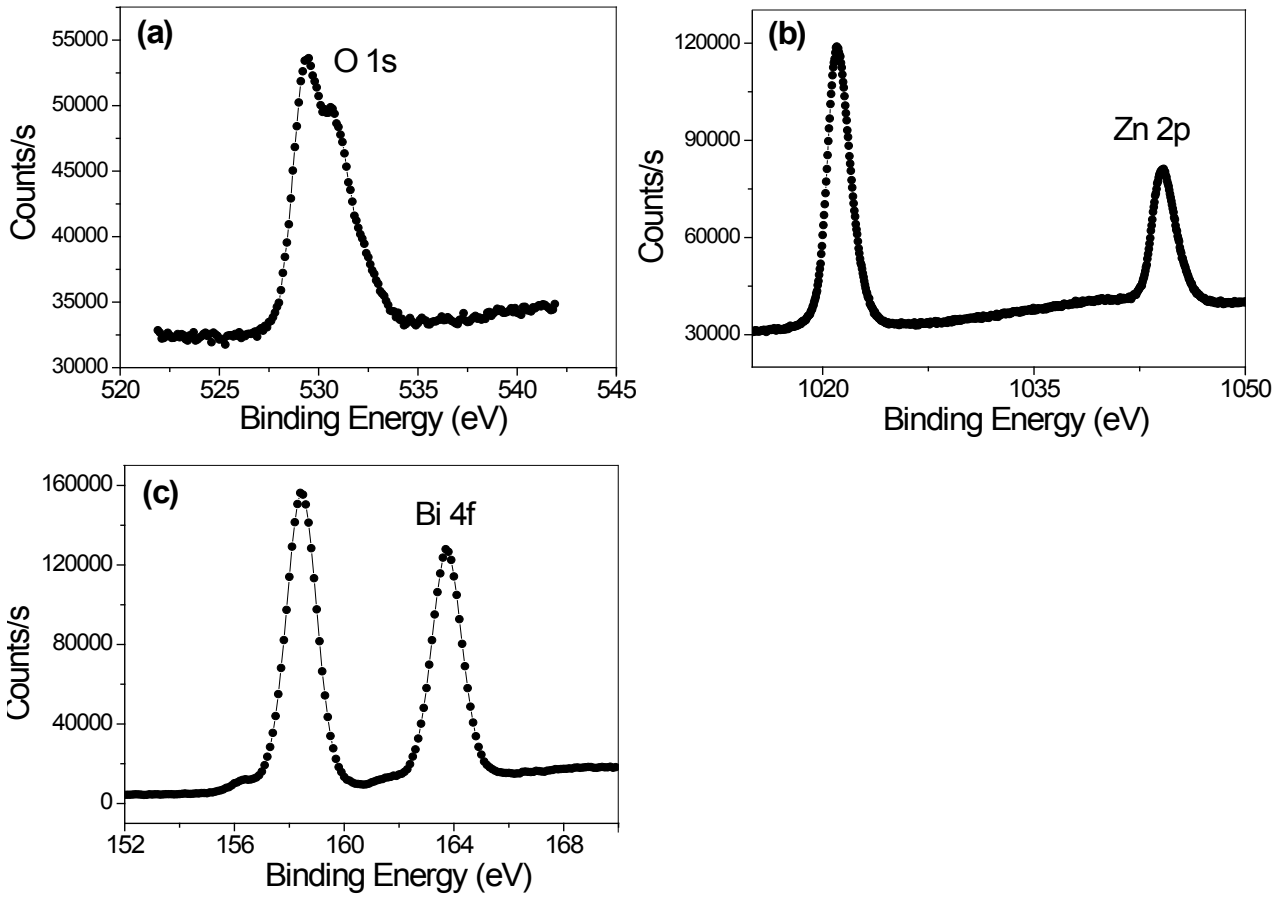

Fig. S2 XPS spectra of ZnO/Bi_2O_3 core/shell nanorods. (a) O1s; (b) Zn 2p; (c) Bi 4f.

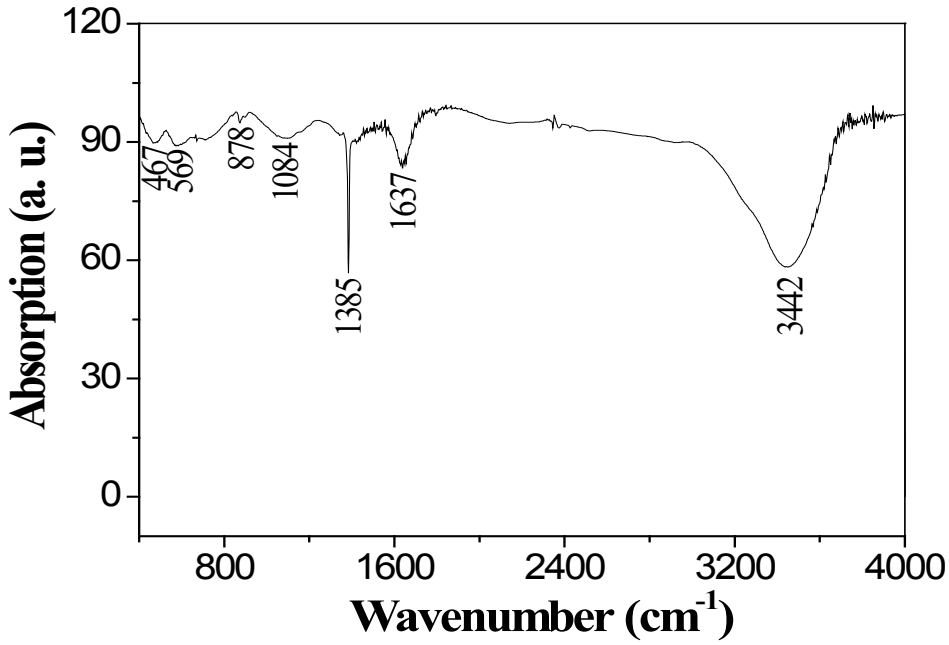

Fig. S3 IR spectrum of ZnO/PANI core/shell nanotubes.