Supporting Information

Facile Synthesis of Water-based Aniline Oligomer Nanowires and Their Uses in Low-Cost Fabrication of Oxide Nanotubes in Aqueous Phase

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Experimental Details

Organic nanowires were synthesized as follows: In a typical experiment, 0.5 g of PVP (molecular weight of 30,000 $g \cdot mol^{-1}$) and 0.1 g of ammonium persulfate (APS) dissolved in 50 g of deionized water was covered with 20 g of xylene to conduct an oil/water interface. Then 0.1 g of aniline was dropped into the upper xylene phase, and the system was kept undisturbed at room temperature for 24 h. Nanowires were generated in the bottom aqueous phase. This approach allowed 0.1 g of aniline to be converted into nearly 90 mg of nanowire. The nanowires were centrifuged at 15,000 r/min for 5 min and rinsed with deionized water before further treatment. For PDDA adsorption, 90 mg of nanowires and 1 g of PDDA solution (20 wt%) were mixed in 20 g of deionized water and stirred at room temperature for 10 min. The modified nanowires were centrifuged and rinsed three times with deionized water before use. For SiO_2 nanotubes, 90 mg of PDDA-modified nanowires, 0.5 g of TEOS, and a drop of N-[3-(trimethoxysilyl)propyl]aniline were mixed with 20 g of deionized water (adjusted to pH=3–4) and stirred at room temperature for 24 h. Templates were removed by THF dissolution. For MnO_2 nanotubes, 90 mg of PDDA-modified nanowires and 0.1 g of $KMnO_4$ were mixed with 20 g of deionized water and stirred at 70°C for 30 min. Templates were removed by THF dissolution. For NiO nanotubes, 40mg of unmodified nanowires, 0.4 g of PVP, 0.2 g of urea, and 0.5 g of nickel nitrate

were poured into 20 g of deionized water, and stirred at 80°C for 3 h to produce a $Ni(OH)_2$ shell. $Ni(OH)_2$ was converted to NiO by calcination at 450°C for 2 h. The temperature was increased at a rate of 2°C·min^{-1}.

Characterizations

The morphologies of samples were observed using a transmission electron microscope (TEM; HitachiH-800, Hitachi Corp.), a scanning electron microscope (SEM) equipped with an energy-dispersive X-ray spectrometer (EDX) with a Philips XL 30 field emission microscope at an accelerating voltage of 10 kV, as well as an optical microscope (OM; KH-7700, HiROX). UV-vis spectra were obtained in UV-vis spectrophotometer (Mapada, UV-1800PC Spectrophotometer, China) in the 300–1000 nm range. The dehydrated samples were dissolved in various solvents for UV-vis scanning with the corresponding solvents serving as blanks. FTIR was scanned on a Nicolet Nexus 470 FTIR spectrometer with powder-pressed KBr pellets. Nanowires dissolved in THF were conducted for matrix-assisted laser desorption ionization time-of-flight mass spectra (MALDI-TOF MS) measurement. Dithranol was added as matrix with a mass number of 225. X-ray powder diffraction (XRD) was measured on a Bruker D4 diffractometer at a scanning rate of 1° min^{-1}, with graphite monochromated Cu Kα radiation (λ=1.5406 nm). TGA analysis was performed in N_2 from room temperature to 800 ^oC at a heating rate of 10 $^oC \cdot min^{-1}$. Nanotube powders were adhered onto conductive adhesive (used as substrate) for EDX analysis. The powder layer is thick enough to cover substrate. As a result, the signal of substrate is negligible.

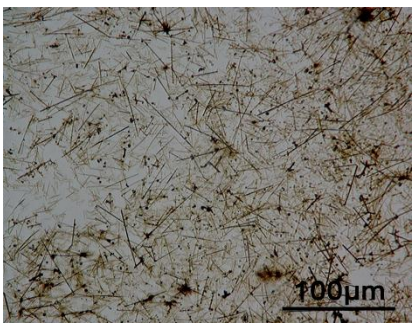

Fig. S1. OM image of nanowires prepared without PVP. Poor dispersion and severe sedimentations are observed.

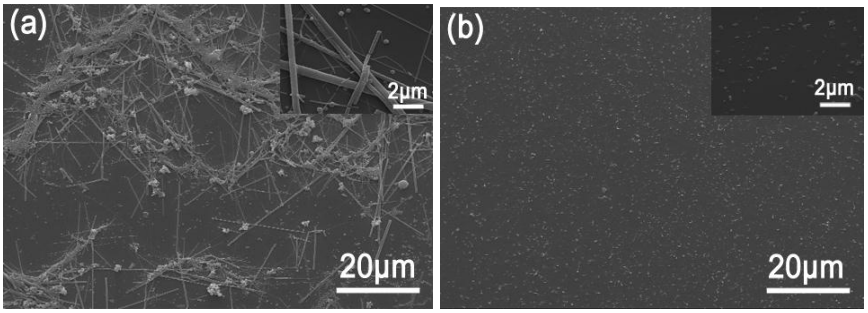

Fig. S2. SEM images of nanowires treated by (a) ultrasonication for 1 min, (b) dissolved by THF. Insets are their corresponding magnified images.

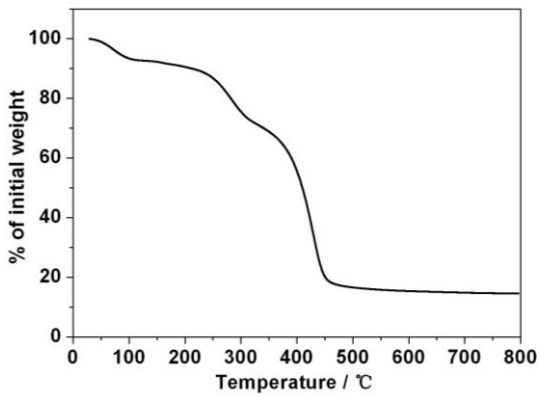

Fig. S3. TGA curve of nanowire in N_2 from room temperature to 800°C at a heating rate of 10°C·min^{-1} [1].

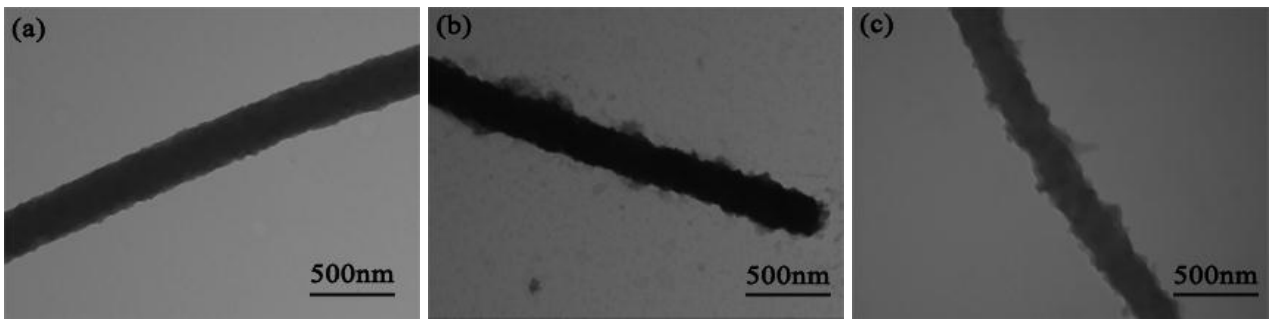

Fig. S4. TEM images of organic nanowires covered by: (a) SiO_2 shell; (b) MnO_2 shell; (c) $Ni(OH)_2$ shell.

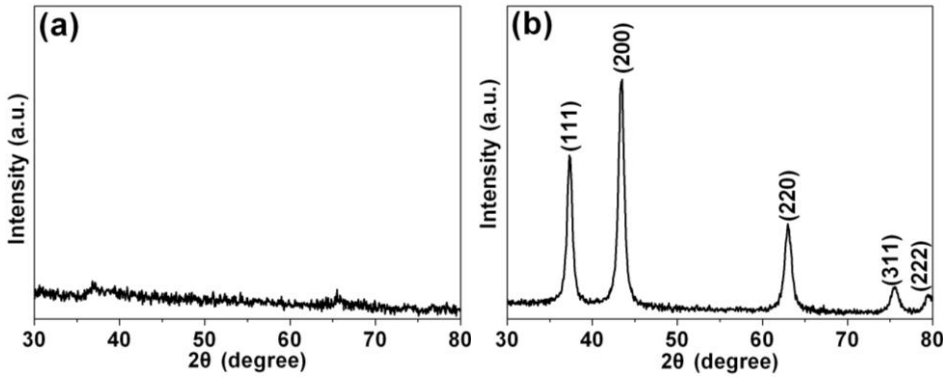

Fig. S5. XRD results of (a) MnO_2 nanotubes (templates were removed by THF dissolution), (b) NiO nanotubes (sample was calcinated at 450°C for 2h).