# Electronic Supplementary Information

## Gas-assisted Growth of Boron-doped Nickel Nanotube Arrays: Rapid Synthesis, Growth Mechanisms, Tunable Magnetic Properties, and Super-Efficient Reduction of 4-Nitrophenol

Xiang-Zi Li, [a,b] Kong-Lin Wu, [a] Yin Ye, [a] and Xian-Wen Wei*[a]

[a] College of Chemistry and Materials Science, Key Laboratory of Functional Molecular Solids, Ministry of Education, Anhui Laboratory of Molecule-based Materials, Anhui Normal University, 241000 Wuhu (China) Fax: +86 553-3869303; E-mail: xwwei@mail.ahnu.edu.cn

[b] Department of Chemistry, Wannan Medical College, 241002 Wuhu (China) E-mail: lixiangzi@wnmc.edu.cn

### Experimental Section

**Synthesis of Boron-doped Nickel Nanotube Arrays.** Anodisc 25 alumina filtration membranes with a rated pore diameter of 200 nm were purchased from Whatman. Two quartz utensils were used as electrobath, between which an AAO membrane is mounted, a certain amount of $NaBH_4$ and $NiSO_4$ aqueous solution (mole ratio is 2:1) were injected into each quartz utensil individually. All the reagents used in the experiment were AR purity. Electroless deposition was conducted at room temperature about 150 s. After deposition, the as-prepared AAO membrane filled with Nickel was washed with distilled water and absolute alcohol and dried in vacuum for further analysis. At the same reaction condition, boron-doped Ni powders were obtained under stir without AAO template. Pure noncrystalline Ni nanotubes also were prepared by our previous electrodeposition method [1].

**Instruments and Product Treatment.** The morphologies of the Ni nanotubes were observed by scanning electron microscopy (SEM, Japan, Hitachi S-4800) and transmission electron microscopy (TEM, Japan, JEM-2010). The structure of the nanotubes was characterized by X-ray diffraction

(XRD, Shimadzu, XRD-6000). The component of the nanotubes was tested by energy depressive X-ray spectrometry (EDX, Japan, Hitachi S-4800) attached to SEM, X-ray photoelectron spectroscopy (XPS, Thermo Escalab 250) and inductively coupled plasma-optical emission spectrometer (ICP-OES, American, Optima 5300DV). The magnetic properties of the nanotube arrays embedded in the AAO membrane were measured by vibrating sample magnetometer (VSM, American, Lake Shore 7410) at room temperature. To obtain fine SEM images of surface array, the as-prepared AAO membrane was partly etched with 2M NaOH aqueous solution followed rinse with distilled water several times. For TEM observations, the AAO membrane was completely dissolved in 2M NaOH aqueous solution and washed with distilled water, and then the black solid was obtained.

**Catalytic Reduction of 4-Nitrophenol.** To test the catalytic activity of the as-prepared Ni nanotubes, the reduction of 4-Nitrophenol (4-NP) by an excess of $NaBH_4$ as the model reaction in water was chosen. The catalytic redox reaction process was set up in a standard quartz cuvette with 1 cm path length and 4 mL volume. Initially, freshly prepared $NaBH_4$ aqueous solution (1.0 mL, $6\times10^{-2}$ M) was added to the above quartz cuvette containing 4-NP (1.0 ml, $3\times10^{-4}$ M) at room temperature and the solution color immediately changed from light yellow to yellow–green. 1.0 ml aqueous Ni nanotubes (100 mg/L) were added to the above solution. A Hitachi U4100 spectrophotometer over a scanning range of 270–500 nm was employed to monitor the reaction at room temperature. The rate constant of the reaction was measured by the extinction of the solution at 400 nm as a function of time.

## Reference

1 X. Z. Li, X. W. Wei and Y. Ye, *Mater. Lett.* 2009, *63*, 578–580.