Supporting Information

Rational Design of Galvanically Replaced Pt-Anchored Electrospun WO₃ Nanofibers as Efficient Electrode Materials for Methanol Oxidation

Zhi-gang Zhao,* Zhao-Jun Yao, Jing Zhang, Rui Zhu, Yu Jin, Qing-wen Li*

Suzhou Institute of Nano-Tech and Nano-Bionics,
Ruoshui Road 398, Suzhou 215123, China

[1] Experimental details:

Characterization: X-ray diffraction (XRD) patterns of the prepared samples were recorded on a Bruker AXS D8 Advance X-ray diffractometer with a Cu Kα radiation target (40 kV, 40 mA). The N₂ sorption measurement was performed using Micromeritics ASAP2020 at 77 K, and the specific surface area and the pore size distribution were calculated using the Brunauer Emmett Teller (BET) and Barrett Joyner Halenda (BJH) methods, respectively. Field emission scanning electron microscopy (FE-SEM) analysis was performed on a FEI Quanta 400 FEG field emission scanning electron microscope. Transmittance electron microscopy (TEM) images were obtained on a FEI Tecnai G2 F20 S-Twin electron microscope operating at 200 kV. Energy-dispersive X-ray spectra (EDS) were collected from an attached Apollo 40 SDD energy-dispersive spectrometer fixed on a FEI Quanta 400 FEG field emission scanning electron microscope.

Electrochemical measurements: Cyclic voltammetry and chronoamperometry were performed on a CHI605D Electrochemical Analyzer. The measurements were made using a three electrode cell set up. An Ag/AgCl, saturated KCl electrode and a Pt foil were used as reference and counter electrodes, respectively. WO₃-supported Pt nanoparticles and carbon nanotubes are mixed and stirred in DMF solution. Then a known amount of the dispersion was transferred onto a glassy carbon electrode as a working electrode, and dried slowly under irradiation with incandescent light. A solution of 1M CH₃OH in 1M H₂SO₄ was used to study the methanol oxidation activity. All the electrochemical studies were performed at a scan rate of 25mVs⁻¹. Pt loading used in all samples is 60 µg/cm² and the geometric area of the working electrode is 0.07 cm².
Nitrogen adsorption-desorption isotherm plot of electrospun WO₃ nanofibers and commercial WO₃ particles:

**Figure S1:** Nitrogen adsorption-desorption isotherm plot of (a) commercial WO₃ and (b) WO₃ nanofibers, and (c) Barrett-Joyner-Halenda (BJH) pore size distribution plot of WO₃ nanofibers.

Commercial WO₃ particles are found to have only a low BET surface area of about 3-4 m²g⁻¹. However, According to Tuan-Anh Nguyen et al.'s studies (Materials Letters 65 (2011) 2823–2825) and our studies, the specific surface area of electrospun WO₃ nanofibers of different diameters can reach up to about 10-40 m²g⁻¹, which is much larger than that of commercial WO₃ particles. Moreover, the pore-size distribution plot indicates the electrospun WO₃ nanofibers contain a large number of mesopores, which could be attributed to the inter-gain space within the nanofibers (Materials Letters 65 (2011) 2823–2825).
Schematic illustration of Pt nanoparticle deposition on tungsten oxide nanofibers and carbon nanotubes

**Figure S2:** Schematic illustration of Pt nanoparticle deposition on tungsten oxide nanofibers and carbon nanotubes

**Figure S3:** Energy-dispersive X-ray spectroscopy (a, b) and X-ray diffraction patterns (c) of Pt nanocubes and nanospheres-decorated WO$_3$ nanofibers
[5] SEM images of commercial WO₃ particles decorated with and without Pt nanoparticles:

**Figure S4:** SEM images of (a, b) commercial WO₃ particles; (c, d) Pt nanocubes-deposited commercial WO₃ particles; (e, f) Pt nanospheres-deposited commercial WO₃ particles.