Controllable Preparation of SnO_2 Nanorods/nanotubes by Electrochemical Route

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【Introduction】 Being an important n-type semiconductor with a wide band gap, SnO_2 especially one-dimensional (1D) nanostructured SnO_2 has attracted a great deal interest due to the promising applications in optoelectronic devices, photocatalysts, solar cells, and so on. In recent years, 1D nanostructured SnO_2 including nanowires, nanoribbons, nanobelts, and nanotubes have been successfully prepared with various methods, such as solvothermal method, solution-phase growth, vapor-liquid-solid (VLS) growth, etc. Here, we reported a facile preparation of 1D SnO_2 nanorods and nanotubes via a template-assisted electrochemical route at low temperatures, using nanoporous polycarbonate (PC) membrane with a uniform pore size of 100 nm as the template.

【Experimental】 Fig.1 shows the electrochemical cell employed in this work. In a typical procedure, the PC membrane was first cleaned with acetone and distilled water by ultrasonication for 30 min in sequence. Then, a conductive metal layer was sputtered on one side of the PC membrane. The sputtered side of the PC membrane was attached in contact with the Cu-foil-covered bottom (cathode) of the electrochemical cell. In the upper side of the cell, a disc-shaped Pt foil (anode) was set in parallel with the PC membrane. Afterwards, electrodeposition was performed in this cell for 30 min, using Sn^{2+}-containing solution as the electrolyte. The temperature of the electrolyte was fixed at 70 °C. Finally, the PC membrane was removed by chloroform to obtain the separated 1D SnO_2 nanostructure units.

【Results】 Fig.2. (a) and (b) show the SEM images of the 1D SnO_2 prepared by adjusting the experimental conditions properly. As can be seen, a controllable synthesis of 1D SnO_2 in both morphology (nanorods or nanotubes) and size (e.g. aspect ratio for nanorods, wall thickness for nanotubes) was realized inside the nanochannels of the nanoporous PC membrane. Besides, the morphology and size of the 1D SnO_2 nanostructures were found to play an important role in determining their optical properties.

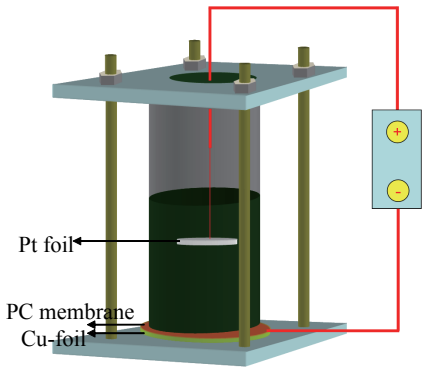

Fig.1. Schematic diagram of the electrochemical cell for 1D SnO_2 electrodeposition.

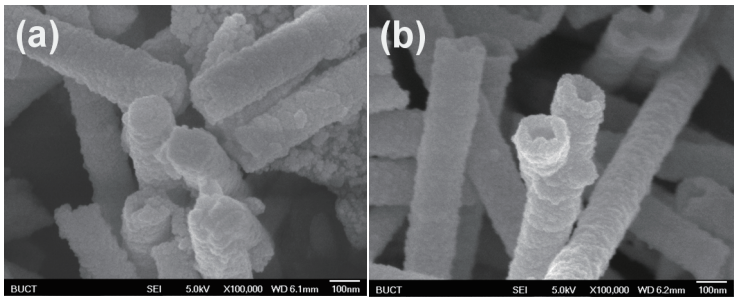

Fig.2. SEM images of 1D SnO_2 (a) nanorods and (b) nanotubes.