Supplementary Material (ESI) for RSC Advances

Simple electrochemical synthesis of ultra-long silver telluride nanotubes **

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Experimental

Silver nitrate ($AgNO_3$, 99.9%), Polyvinylpyrrolidon (PVP, MW=1,300,000), and Tellurium oxide (TeO_2) were purchased from Sigma Aldrich and used without further purification.

Electro-spinning of Ag nanofibers.

PVP (0.5 g) and $AgNO_3$ (2 g) were dissolved in a mixed solvent of anhydrous ethanol (4 ml) and DI-water (6 ml). The above solution was stirred at room temperature for 12 h to create a homogenous solution. The mixed solution was loaded into a plastic syringe connected to a nozzle connector with a 30 gauge (0.14 mm, diameter) capillary tip placed at the end of it. At this time, the nozzle connector was also connected to a high voltage power supply. After assembling electrospinning setup, the solution was fed at a constant flow rate of 0.2 ml/h using a syringe pump. A voltage of 20 kV was applied, and the distance between the capillary tip and the drum collector was 15 cm. The substrate (1.5×1.5 cm) was positioned on a drum collector. The electro-spinning was performed at 35°C. The $AgNO_3$/PVP nanofibers were reduced to the Ag nanofibers by two-step calcination at 150°C (a heating rate 2°C/min) for 3 h in hydrogen atmosphere and at 250°C (a heating rate 2°C /min) for 90 min in air atmosphere, respectively.

Electrochemical transformation into the Ag_2Te nanotubes.

The Ag nanofibers were employed in an electrodeposition process to synthesize the ultra-long Ag_2Te nanotube. The electrolyte was prepared by dissolving TeO_2 in a concentrated nitric acid with DI water. The concentration of the electrolyte was 10 mM $HTeO_2$ and 1 M HNO_3. Cyclic voltammetry measurements were carried out between -0.5 V and 1 V at a scan speed of 50 mV using the Ag nanofiber-based film as the working electrode. The electrodeposition process was performed at a potential of -0.05 V with stirring with the Ag/AgCl (sat.KCl) reference electrode and a platinum-coated counter electrode.

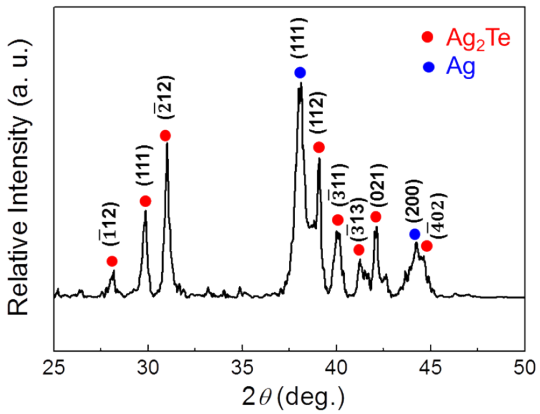

Fig. S1 XRD result of the early-staged sample reacted for 10 min shows that the product is composed of unreacted Ag and Ag_2Te phase.

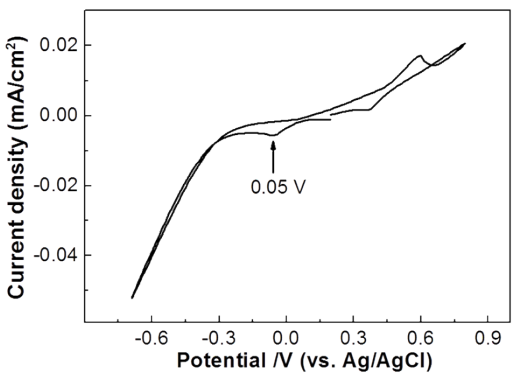

Fig. S2 Cyclic voltammogram in the electrochemical solution containing 1 M HNO_3 and 10 mM TeO_2.

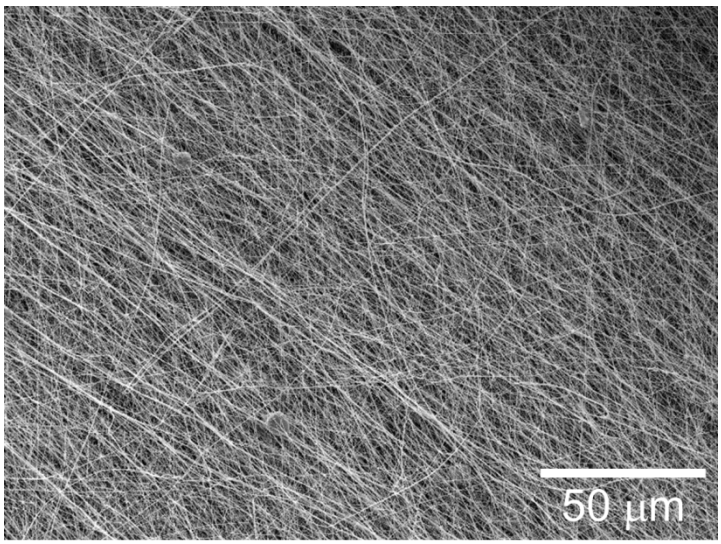

Fig. S3 Low-magnification SEM image of Ag_2Te nanotubes on the polyimide substrate, representing the ultra-long morphology of nanotubes in lengths.

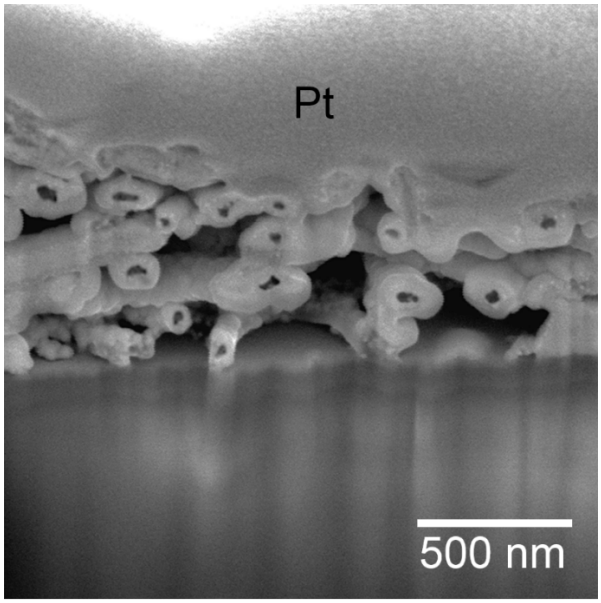

Fig. S4 Cross-sectional SEM image of Ag_2Te nanotubes indicates the morphological transformation into nanotubes with the hollow structure. Due to Pt deposition of focused ion beam (FIB) process to prepare the cross-sectional sample, the typical tubular morphologies of some nanotubes were collapsed.