Electronic supplementary information for:

Facile template-based high-yield-transformation synthesis and electrocatalytic properties of PdTe nanowires

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1. Experimental Section

Materials. Palladium chloride , hydrazine hydrate (50% w/w%), ammonia solution (25 wt.%), polyvinylpyrrolidone (PVP K30, M_w 55000-58000) and sodium tellurite (Na_2TeO_3) were obtained from Sinopharm (Shanghai, China). Ascorbic acid (AA) and commercial Pd/C (10 wt.%) were purchased from Aladdin Chemistry Co. Ltd (Shanghai, China). H_2PdCl_4 (56.4 mol L^{-1}) was prepared according to our reported method[1] with small modifications, just by changed the amount of $PdCl_2$ to 0.1 g and the volume of the concentrated HCl to 0.1 mL, respectively. All of the chemicals used in this experiment are of analytical grade and used as just received. Milli-Q water

(≥18.2 MΩ cm) was used during the whole experiments.

Synthesis of Te nanowires. The process was our reported synthetic path.[2] The process is firstly by mixing Na_2TeO_3 (0.09 g) and PVP (1 g) into water (30 mL), stirred to dissolved. Then, using a pipette to inject the hydrazine hydrate (1.5 mL) and an ammonia solution (3 mL) into above solution. After stirred for 10 min, the solution was poured into a Teflon-lined stainless steel autoclave, sealed and put into an oven at 180 ºC for 4 h. After that, the product was cooled and precipitated by acetone, and cleaned with water twice. The final Te nanowires product is dispersed in 35 mL of water for the further usage, the concentration of Te nanowires in this solution is about 11 mmol L^{-1}.

Synthesis of PdTe nanowires. For synthesizing PdTe nanowires, 1 mL of the above Te nanowires suspension were transferred into 15 mL of water which containing 1 mL of AA (0.1 mol L^{-1}). Then 0.4 mL of H_2PdCl_4 (56.4 mol L^{-1}) was injected into the above solution. After reacted for 30 minutes, the product was collected by centrifuged at 8000 rpm for 15 min, followed by washed several times with Milli-Q water.

Apparatus. The morphology, composition and structure and of the PdTe nanowires were analyzed with TEM and HRTEM, HAADF-STEM, elemental mapping, EDS and cross-sectional compositional line profiles measurements. These processes were conducted on a TECNAI G2 TEM with an accelerating voltage of 200 kV. XRD pattern of PdTe nanowires was measured on a D8 ADVANCE (BRUKER, Germany). XPS of PdTe nanowires was recorded on an ESCALAB-MKII spectrometer (VG Co.,

United Kingdom).

Electrocatalytic process measurements. A CHI 832B electrochemical workstation, Chenhua Instruments corp (Shanghai, China) is used to test all the electrochemical process. Before the measurement, the working electrode was prepared the same as our reported process.[1,2] The Pd loading mass was 37.1 μg cm^{-2}.

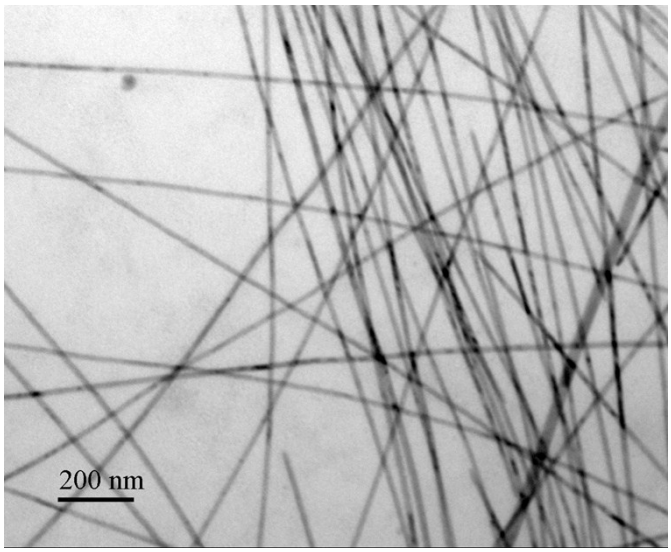

Fig. S1 Typical TEM images of the as-prepared Te NWs.

Equation S1.

Conversion efficiency (%)=$m_{Pd\text{-}product}$ / $m_{Pd\text{-}precursor}$ * 100,

in the above equation, $m_{Pd\text{-}product}$ represents the Pd mass of the final PdTe NWs, while the $m_{Pd\text{-}precursor}$ represents the Pd mass of the original Pd precursor (namely the used H_2PdCl_4).

$m_{Pd\text{-}precursor}=Ar_{(Pd)} * V_{(H2PdCl4)} * C_{(H2PdCl4)}$, in this equation, $Ar_{(Pd)}$ refers to the relative atomic weight (106.4), $V_{(H2PdCl4)}$ refers to the volume of the used H_2PdCl_4 solution (0.4 mL), $C_{(H2PdCl4)}$ refers to the concentration of the used H_2PdCl_4 solution (0.0564 mmol L^{-1}).

While the $m_{Pd\text{-}product}$ can be calculated as follows,

We can firstly got the Pd concentration from ICP-MS measurement results as follows,

Pd: 24.14 ppm

From the ICP results we can know, m_{Pd} (ICP) = 24.14 μg mL^{-1}

Actually, we need to dilute the original solution of the product because aqua regia should be added to dissolve the product. So the original weight of Pd should multiply the diluted volume. m_{Pd} (original) =24.14 × 25=603.5 μg mL^{-1}=0.604 mg mL^{-1}, while the volume of the product can also be measured, hence the $m_{Pd\text{-}product}$ can be calculated similarly.

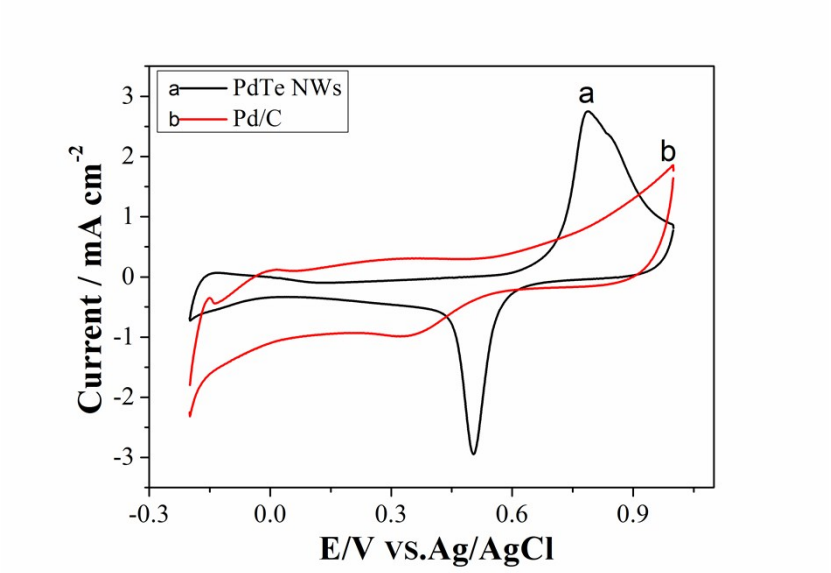

Fig. S2 CV profiles of PdTe NWs (after electrochemical treatment) and Pd/C recorded in 0.5 mol L^{-1} H_2SO_4 solution at a sweep rate of 50 mV s^{-1}.

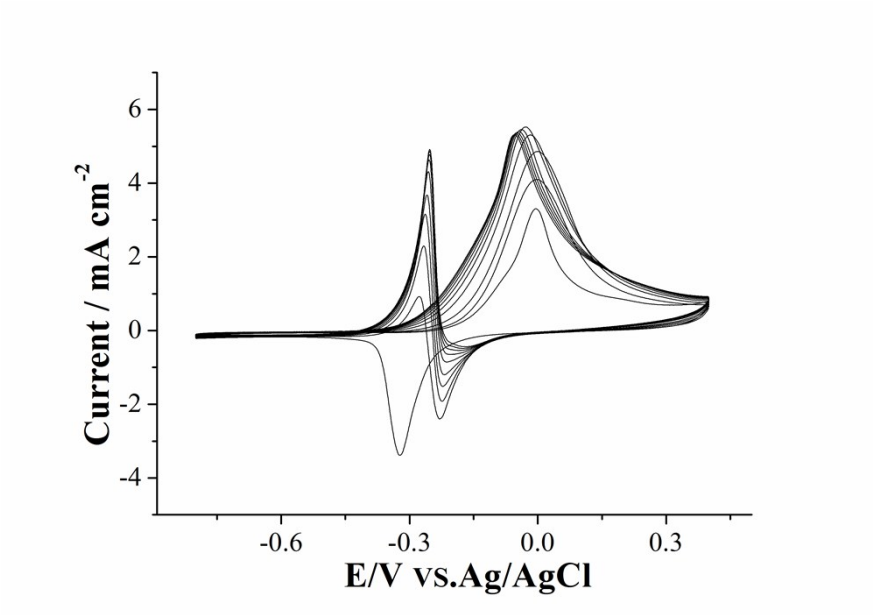

Fig. S3 The initial several scan cycles of the CV curve of PdTe NWs (without CV electrochemical treatment) toward ethylene glycol electrooxidation in a solution containing 0.5 mol L^{-1} potassium hydroxide and 0.5 mol L^{-1} ethylene glycol.

Reference

1 W. Hong, Y. Liu, J. Wang, E. Wang, *Electrochem. Commun.*, 2013, **31**, 59-62.

2 W. Hong, J. Wang, E. Wang, *Small*, 2014, **10**, 3262-3265.