Electronic Supplementary Information

One-step preparation of ZnO nanoparticle-decorated reduced graphene oxide composites and their application to photocurrent generation

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Experimental section

Graphite powder, H2SO4, NaNO3 and H2O2 (30%) were purchased from Aladin Ltd. (Shanghai, China). Ammonia (25wt%), HCl (36wt%) and KMnO4 were purchased from Beijing Chemical Corp. Zn plate was purchased from Tianjin Guangfu Fine Chemical Research Institute. 8,13-Bis(1,2
dihydroxyethyl)-3,7,12,17-tetramethyl-21H,23H-porphine-2,18-dipropionic acid zinc(II) (ZnP) was purchased from Frontier Scientific, Inc. The water used throughout all experiments was purified through a Millipore system.

GO was prepared from natural graphite powder through a modified Hummer’s method\(^1\) using graphite powder, H\(_2\)SO\(_4\), NaNO\(_3\) and H\(_2\)O\(_2\) (30\%) as the starting materials. As-synthesized GO was dispersed into individual sheets in distilled water at a concentration of 0.25 mg/mL with the aid of ultrasound for further use.

The preparation of rGO-ZnO composites was carried out as follows: In a typical experiment, 5 mL of ammonia solution (25\%) was added into 5 mL of GO dispersion (0.25 mg/mL) at ambient temperature. The mixture was ultrasounded for 2 min to obtain a homogeneous solution. After that, a Zn plate with surface area of 4 cm\(^2\) was immersed in the above solution and a 20-min untrasonication was applied. The brown GO suspension changed into black and sinking at the end. The samples were washed with water twice. For rGO-ZnO-ZnP preparation, as-synthesized rGO-ZnO dispersion was stirred with 1 mg/ml ZnP ethanol solution in dark for 1 h. Then the sample was collected by centrifugation and washed with ethanol.

UV-vis spectra were obtained on a UV-1800 Spectrophotometer. Transmission electron microscopy (TEM) measurements were made on a HITACHI H-8100 electron microscopy (Hitachi, Tokyo, Japan) with an accelerating voltage of 200 kV. The sample for TEM characterization was prepared by placing a drop of sample solution on carbon-coated copper grid and dried at room temperature. Scanning
electron microscopy (SEM) measurements were made on a XL30 ESEM FEG
scanning electron microscope at an accelerating voltage of 20 kV. Samples for SEM
examination were made by placing a drop of the dispersion on a glass slide and
air-dried at room temperature. Raman spectra were obtained on J-Y T64000 Raman
Spectrometer with 514.5 nm wavelength incident laser light. Photoelectrochemical
measurements were composed of a CHI 660D electrochemical analyzer (CH
Instruments, Inc., Shanghai), a 500 W xenon lamp (CHFXQ500W, Beijing) with
cutoff filter ion (\(\lambda > 400\) nm), and a homemade three-electrode cell using a
KCl-saturated Ag/AgCl electrode, a platinum wire, and rGO-ZnO with or without ZnP
as the reference, counter, and working electrodes, respectively. The rGO-ZnO
modified ITO electrode was prepared by dip-coating method: typically, 100 μL of
rGO-ZnO suspensions was dip-coated onto a 0.5 cm \(\times\) 4 cm indium-tin oxide (ITO)
glass electrode. The electrode was then exposed to an infrared light to eliminate the
solvent. For rGO-ZnO-ZnP, ZnO-ZnP and ZnP modified ITO electrode, the same
method was followed except for the electrodes were air-dried in dark at room
temperature. The supporting electrolyte was 1 M Na\(_2\)SO\(_4\), which was purged with
high-purity nitrogen for at least 15 min prior to experiments.

Reference

Fig. S1 Raman spectra of (A) GO and (B) rGO-ZnO composites.
**Fig. S2** UV-vis absorption spectra of the rGO-ZnO and rGO-ZnO-ZnP modified ITO electrode.