Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

Fabrication of antimony doped tin oxide-graphene nanocomposite for high effective capacitive deionization of saline water

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1. Materials and Characterization

Graphite powder (KS-10) for graphite oxide (GO) preparation, H_2SO_4 (98%), H_3PO_4 (85%), $KMnO_4$ (A. R.), H_2O_2 (30%), HCl (37%), $SnCl_2 \cdot 2H_2O$ (98%), $SbCl_3$ (99%) and $NH_3 \cdot H_2O$ (25%) were used without any further purification. All the above reagents were purchased from Sinopharm Chemical Reagent Company Limited.

The surface morphology of the composite was studied by a JEOL JSM-5900 scanning electron microscope (JEOL Ltd., Japan) and field-emission scanning electron microscope (FESEM Hitachi S-7400, Japan). High-resolution transmission electron microscopy (HRTEM) was performed by JEOL-2100F. The phase and crystallinity were characterized using a Rigaku X-ray diffractometer (Rigaku Co., Japan) with Cu Kα (λ=1. 54056 Å) radiation over a range of 2θ angles from 5° to 80°. The electrochemical performances of the electrodes were determined using a Versa Stat 4 potentiostat device. The N_2 sorption isotherms and pore size distribution were tested using a 3H-2000PM2 micropore structure analyzer (Beishide Co., Beijing). The chemistry state of elements was evaluated by X-ray photoelectron spectroscopy instrument (XPS, Thermo ESCALAB 250xi spectrophotometer with Al−Kα radiation). Thermogravimetric analysis (TGA) was performed under air flow from 30℃ to 800℃ using a NETZSCH STA 449F3 TGA apparatus. Electrochemical experiments were performed with a CHI660E Electrochemical Workstation.

2. The preparation of graphene oxide

Graphene oxide (GO) was synthesized using conventional Hummer's method with slight modification[1]. 2 g of graphite powder was treated by 180 mL of H_2SO_4 and 20 mL of H_3PO_4 in a 500 mL round-bottomed flask. With constant stirring, 12 g of $KMnO_4$ was slowly added in the ice bath to keep the reaction temperature lower than 20℃. Then the mixture was heated to 50℃ and the reaction was kept for 10 h. The reactant was cooled down to room temperature and H_2O_2 (30%) was injected. Finally, after washing with HCl (10%) and DI water, the mixture was centrifuged for several times and then dried at 60℃ for 12 h.

3. EDX of the fabricated SnO_2-RGO (20 wt.%) nanocomposite

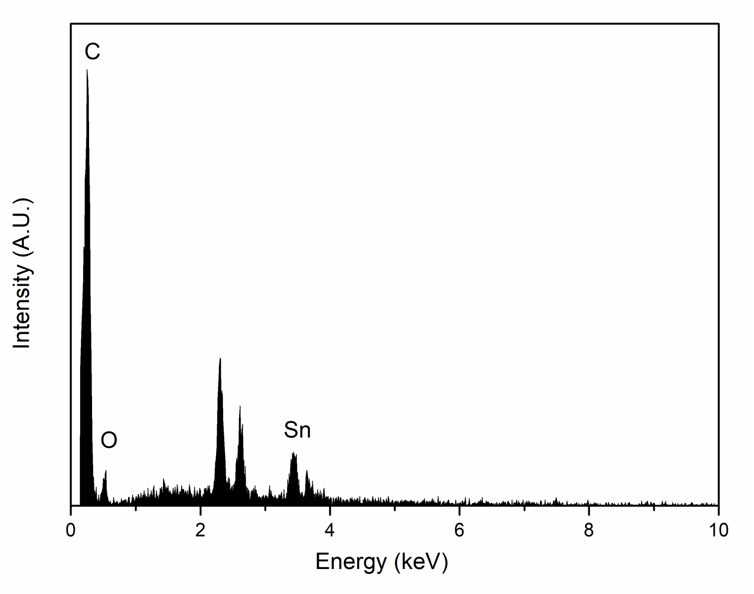

Fig. S1. EDX of the fabricated SnO_2-RGO (20 wt.%) nanocomposite

4. C 1s region in the XPS spectrum of pure RGO

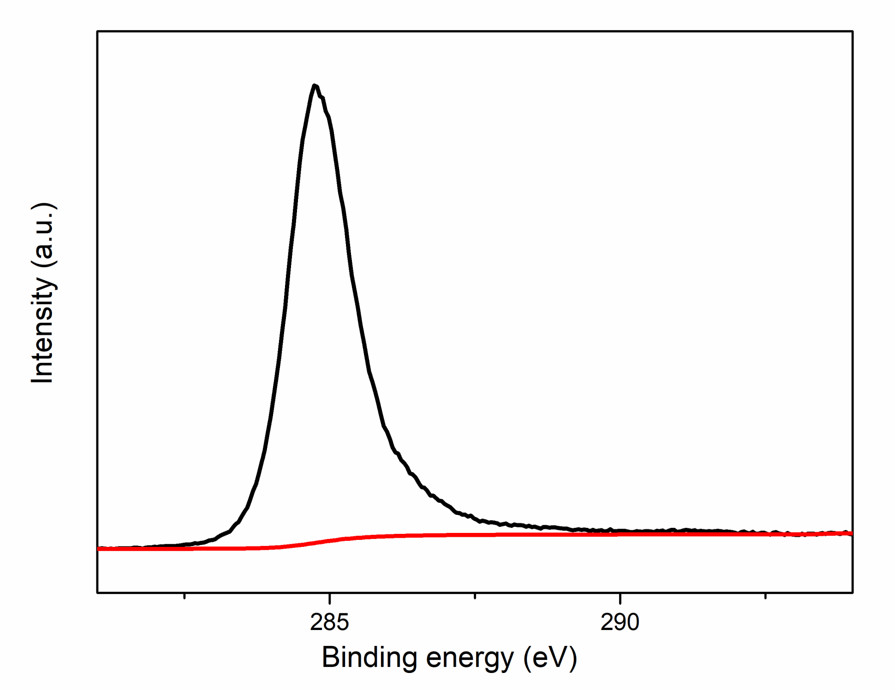

Fig. S2. C 1s region in the XPS spectrum of pure RGO

5. CV curves of pristine RGO and ATO-RGO composites with different mass ratios between ATO and graphene at different scan rates

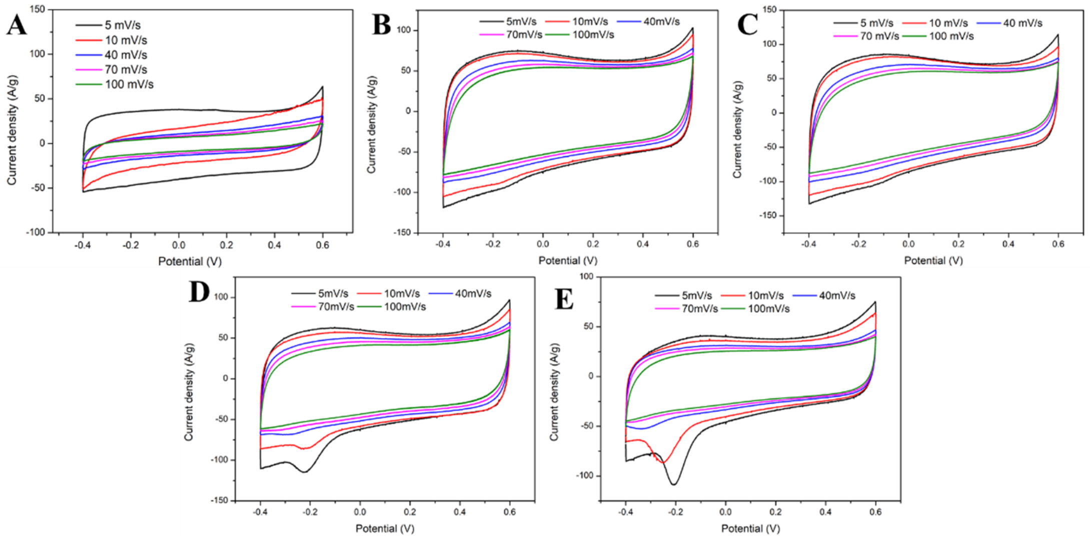

Fig. S3. CV measurements for (A) RGO, (B) ATO-RGO (10 wt.%), (C) ATO-RGO (20 wt.%), (D) ATO-RGO (30 wt.%) and (E) ATO-RGO (40 wt.%) modified electrodes in 1 M NaCl solution at the scan rates from 5 to 100 mV s^{-1}, respectively.

6. The specific capacitance of SnO_2-RGO (20 wt.%).

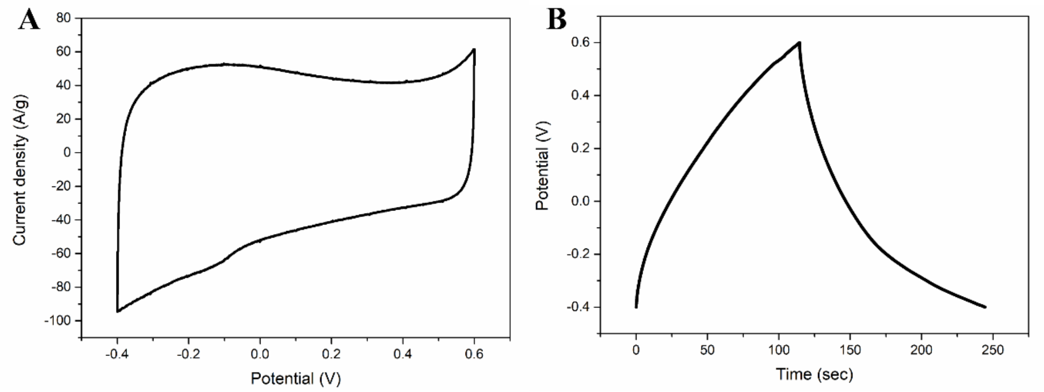

Fig. S4. (A) CV measurement in 1 M NaCl solution at the scan rates of 5 mV s^{-1} and (B) charge-discharge test at a current density of 1 A g^{-1} for SnO_2-RGO (20 wt.%) electrode.

7. CDI performance at different applied voltage in the testing solution.

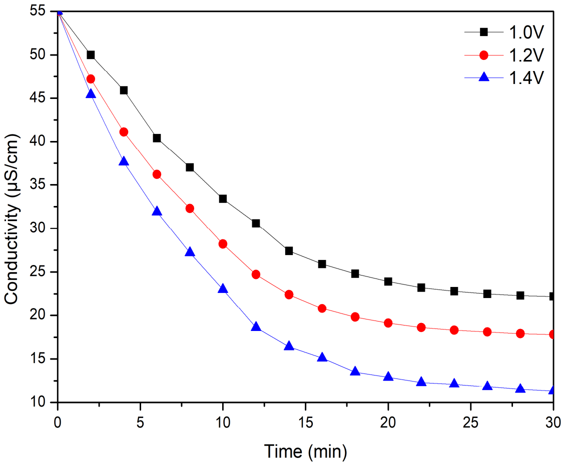

Fig. S5. CDI performance at different applied voltage in the testing solution.

Reference

1 Y. X. Xu, K. X. Sheng, C. Li and G. Q. Shi, *Acs Nano*, 2010, **4**, 4324-4330.