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Supporting Information

High Efficient Solar Seawater Desalination with Environmentally Friendly Hierarchical Porous Carbons Derived from Halogen-containing Polymers

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Content:

1. The dehalogenation of PVC

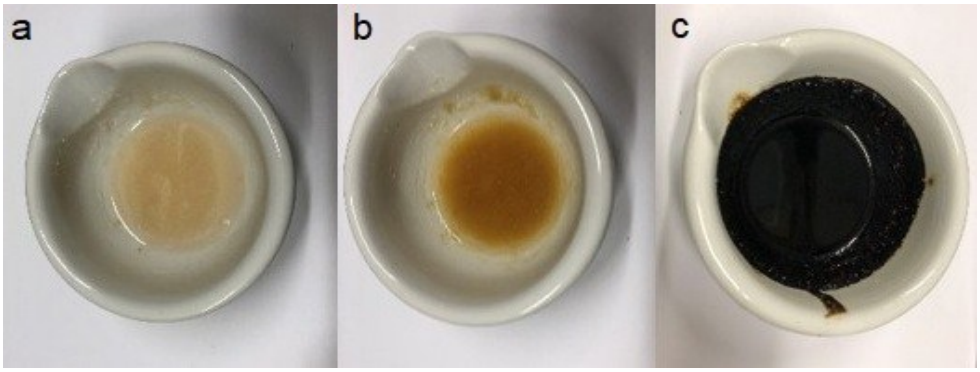

Fig. S1 Color changes of the room temperature dehalogenation process of Polyvinyl Chloride (PVC) by grinding for, (a) 0 min, (b) 3mins, (c) 10 mins. Dimethylformamide (DMF) was used as the solvent and the potassium hydroxide (KOH) is the dechlorination agent.

2. The pore structures of HPC

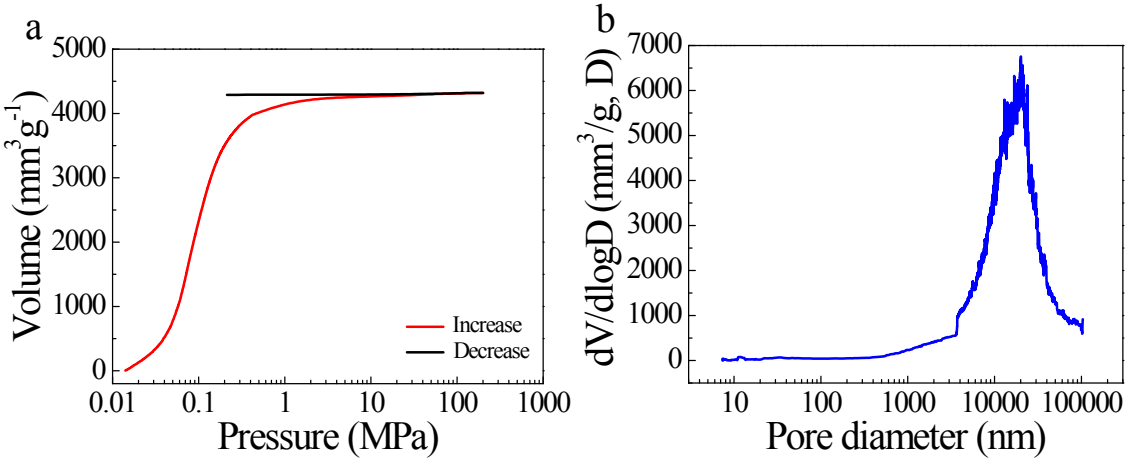

Fig. S2 The mercury intrusion porosimetry results of the HPC. (a) the pore volume with the pressure of mercury intrusion. (b) The typical pore diameter distribution.

3. The X-ray Photoelectron Spectrum (XPS)

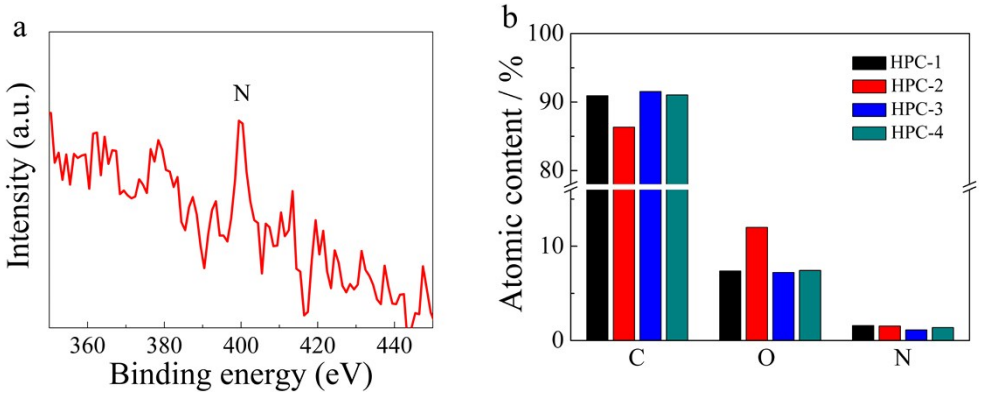

Fig. S3 a) The N1s peak by the X-ray Photoelectron Spectrum (XPS) of HPC-4, confirming the successful doping of nitrogen in the carbon material. b) The carbon (C), oxygen (O) and nitrogen (N) elemental concentrations in the samples.

4. The Raman spectra

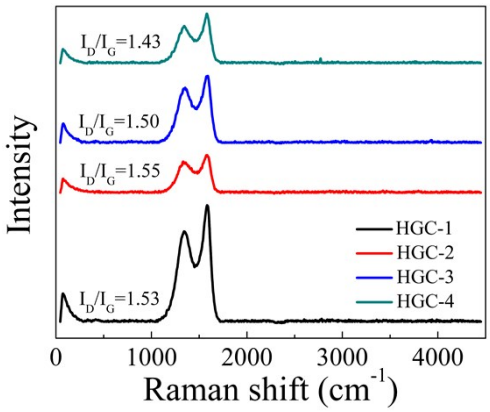

Fig. S4 The Raman spectra of HPC. The typical D-band (≈1350 cm^{-1}) induced by disorder is stronger than the G-band (≈1575 cm^{-1}) induced by in-plane vibrational, suggests a high density of defects. The graphitization degree depending on the amount of defects and disorder structures can be evaluated through the I_D/I_G ratio.[1, 2] As the lower the I_D/I_G ratio, the higher the graphitization degree is. Raman spectra further reveal the structural evolution. The I_D/I_G ratio decreases with the time increase of mechanochemical grinding, suggesting that the number of defects and disorder structures decrease. The D

to G band intensity ratio (I_D/I_G) in HPC-4 is much lower than in the HPC-1 which revealed that graphitization degree increased.

5. The typical TG results of the HPC samples

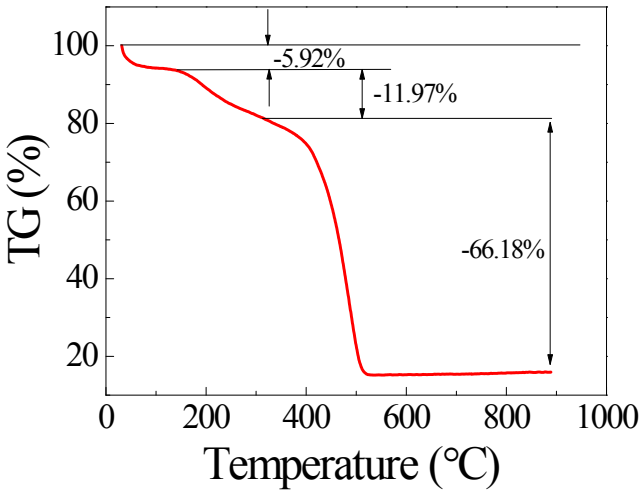

Fig. S5 The typical TG results of an HPC sample.

6. The solar reflectance spectrum of the flexible HPC samples

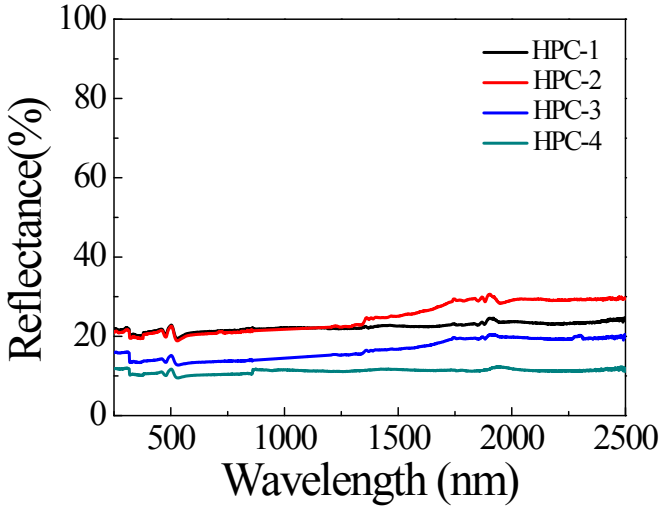

Fig. S6 The solar reflectance spectrum of the flexible HPC samples coated on papers collected from 250 nm to 2500 nm by the UV-Vis-NIR.

7. Energy Conversion Efficiency

The energy conversion efficiency (η_{th}) is a key figure that can be used to visually and efficiently evaluate the efficiency of the solar-to-vapor efficiency. It is defined as[3],

$$\eta_{th} = \frac{\dot{m} h_{LV}}{C_{opt} q_i} \quad (1)$$

where $\dot{m}$ is the mass loss rate of water per unit area which can be calculated from the mass loss curves at the steady state, h_{LV} is the evaporation enthalpy (sensible heat and liquid-vapour phase change), C_{opt} is the optical concentration, and q_i is the nominal direct solar irradiation of 1 kW m^{-2}. In our work, only the phase-change enthalpy is considered And when calculating the evaporation rate, the natural evaporation rate in dark environment 0.224 kg m^{-2} h^{-1} will be subtracted (Figure S7).

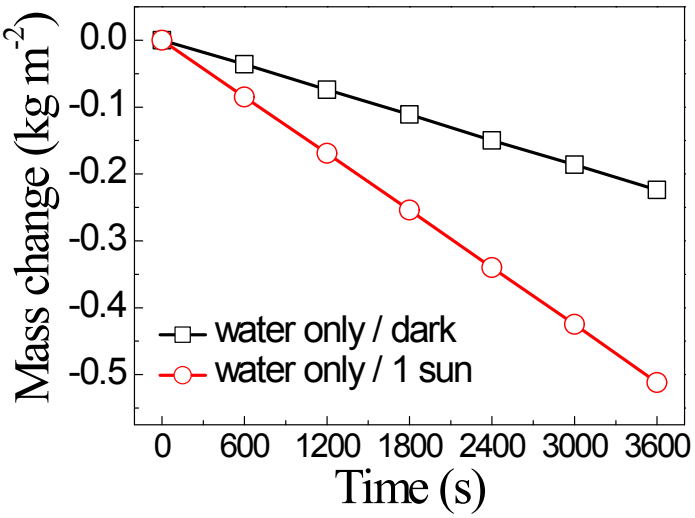

Fig. S7 The evaporation rates vs. time curves of water in the dark environment and under 1 sun irradiation (1 kW m^{-2}).

References

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