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Supplementary Information

Design and synthesis of organic (naphthoquinone) and inorganic (RuO_2) hybrid graphene hydrogel composite for asymmetric supercapacitors

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Contents

1. Calculation formula

The calculation formula for specific capacitance (C, F g^{-1}), energy density (E, W h kg^{-1}) and power density (P, kW kg^{-1}) based on the galvanostatic discharge curves of samples are shown as following:[1-4]

1.1. In three-electrode system, the specific capacitance of an electrode material can be calculated from the equation 1-1:

$$C = I \cdot \Delta t / \Delta V \cdot m \quad (\textit{equ. 1-1}),$$

where I, Δt, ΔV and m are discharging current, discharge time, practical potential window and mass of active material on the working electrode, respectively.

1.2. The proper mass ratio (R) of the positive and negative active materials in two-electrode system can be confirmed by using equation 1-2:

$$R = \frac{m_+}{m_-} = \frac{C_- \Delta V_-}{C_+ \Delta V_+} \qquad (\textit{equ .1-2})$$

where m_+ and m_- refer to mass, C_+ and C_- correspond to specific capacitances, while ΔV_+ and ΔV_- are potential windows of the positive and negative electrodes, respectively.

1.3. In two-electrode system, the specific capacitances of a capacitor can be calculated from the equation 1-3:

$$C = I \cdot \Delta t / \Delta V \cdot M \quad (\textit{equ. 1-3})$$

where I, Δt, ΔV and M are the discharge current, discharging time, cell voltage and total mass of anode and cathode materials, respectively.

1.4. Energy and power densities can be calculated from the following equations:

$$E = C(\Delta V)^2 / 7.2 \qquad (\textit{equ. 1-4})$$

$$P = 3600E/\Delta t \qquad (equ.\ 1\text{-}5)$$

where E, C, ΔV, P and Δt are the specific energy, specific capacitance, potential window, specific power and discharge time, respectively.

2. Characterization

2.1 TEM analysis

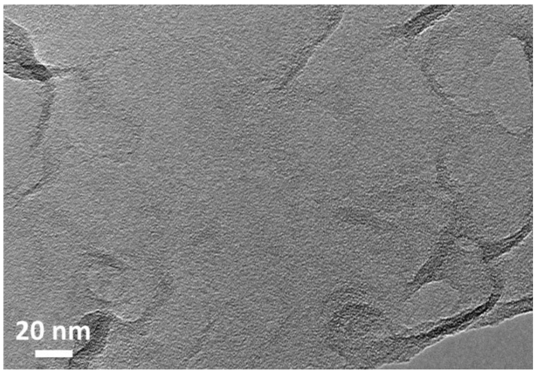

Fig. S1 TEM image of pure SGH.

2.2 Cyclic voltammetry test

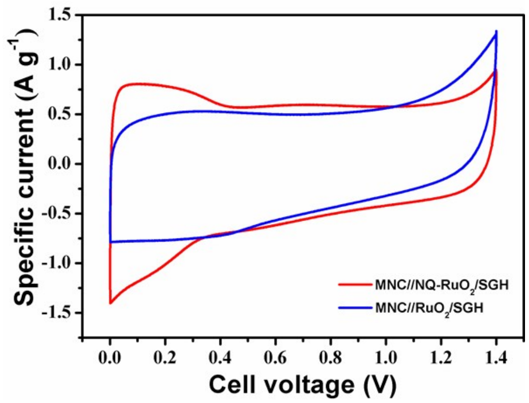

Fig. S2 CV curves of MNC//NQ-RuO_2/SGH and MNC//RuO_2/SGH ASC in 1 mol L^{-1} H_2SO_4

3. References

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