

Graphene covalently functionalized with 2,6-diaminoquinone (DQ) as high performance electrode material for supercapacitors

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Calculations of energy density and power density based on the galvanostatic charge-discharge curves¹:

In two-electrode system, Formula (1) and (2) were employed to calculate the energy density

(E , Wh kg⁻¹) and power density (P , W kg⁻¹)

$$E = \frac{0.5C(\Delta V)^2}{3.6} \quad (1)$$

$$p = \frac{E}{t} \quad (2)$$

where C ($F g^{-1}$) represents the specific capacitance of a two electrode device, t (s) is discharging time and ΔV (V) refers to voltage window.

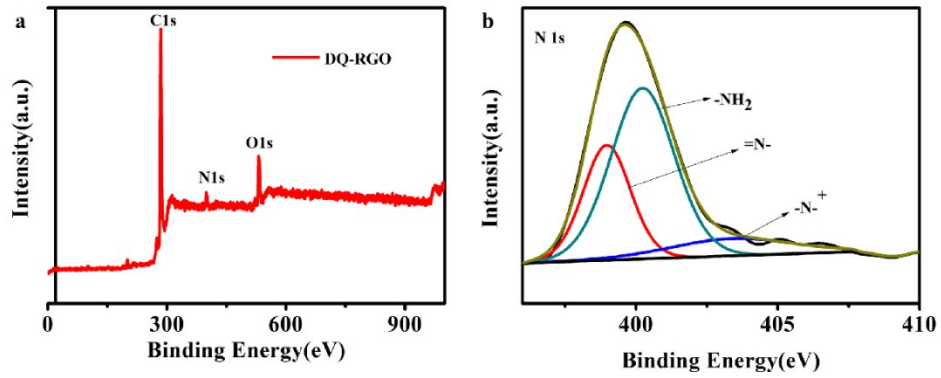


Fig. S1. XPS of the survey scan (a) and (b) N 1s

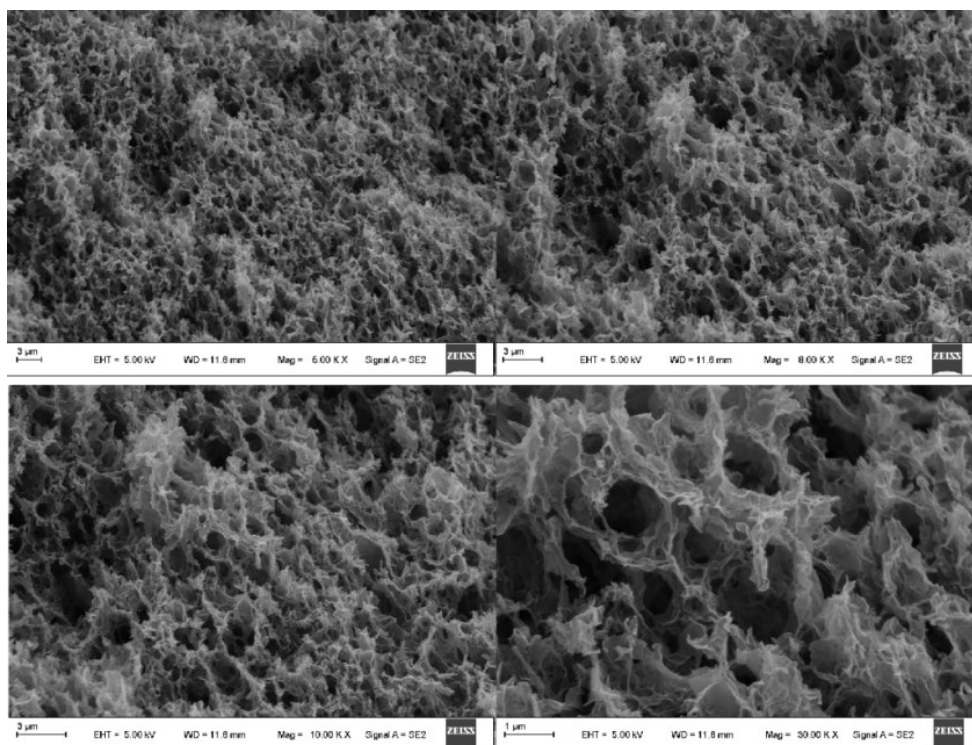


Fig. S2. SEM of RGO

Table S1 Performance comparison of different electrode material

Electrode material	Electrolyte	E_{max} (Wh kg ⁻¹)	P_{max} (kW kg ⁻¹)	Cycle numbers	Capacitance retention (%)	Ref
HQSA-rGO/CF	H ₂ SO ₄	6.25	0.522	-	-	2
RGO-PPy	KCL	2.5	38.6	5000	83	3
SGN//AC	PVA-KOH	7.15	0.02	1000	75	4
rHGO-PPD	H ₂ SO ₄	11.71	0.249	5000	73.6	5
DBU-FG-2	KOH	5.5	0.05	-	-	6
PGO@PANI//AC	KOH	7.91	7.826	1500	77	7
Ferrocene/G	Na ₂ SO ₄	6.19	26	8000	70	8
m-rGOHG80/rGO	H ₂ SO ₄	7.88	0.125	10000	95.5	9

GMP-1.0	-	6.8	3.263	3000	86.7	10
DQ-RGO//Th-GH	H ₂ SO ₄	14.2	0.763	8000	80	This work

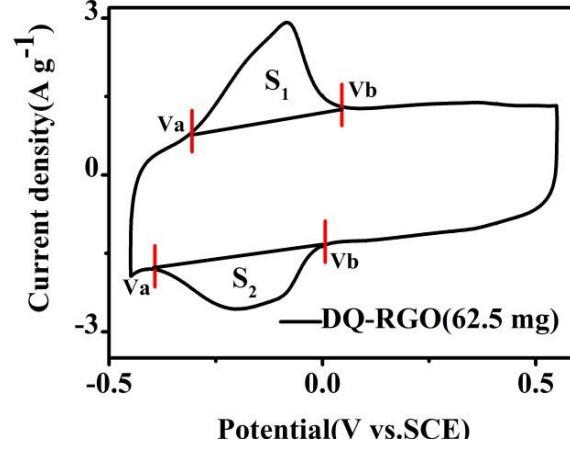


Fig. S3. CV curves of DQ-RGO (62.5 mg) at a scan rate of 5 mV s⁻¹

The calculation formula for the mass of DQ [18]:

$$Q = \int I dt = \int_{V_b}^{V_a} \frac{I}{\frac{dV}{dt}} dV = \frac{1}{v} \int_{V_b}^{V_a} I dV \quad (3)$$

$$m_A = n_A \cdot M_A = \frac{\Delta Q}{ZF} M_A \quad (4)$$

where Q (C), I (A), t (s), V (V), m_A (g), n_A (mol), M_A (mol g⁻¹), F and z are voltammetric charge, instantaneous anodic (cathodic) current at a given potential range, sampling time, potential range, material mass taking part in redox reaction, amount of substance of active materials, molar mass of active materials, Faraday constant and stoichiometric coefficient of electron transport in electrochemical processes while V_a and V_b (V) are the selected boundary of potential range, respectively. ΔQ (C) is defined as a charge contributed by cathodic or anodic reaction of DQ, which is numerically equal to the integral area of the region (S_1 or S_2).

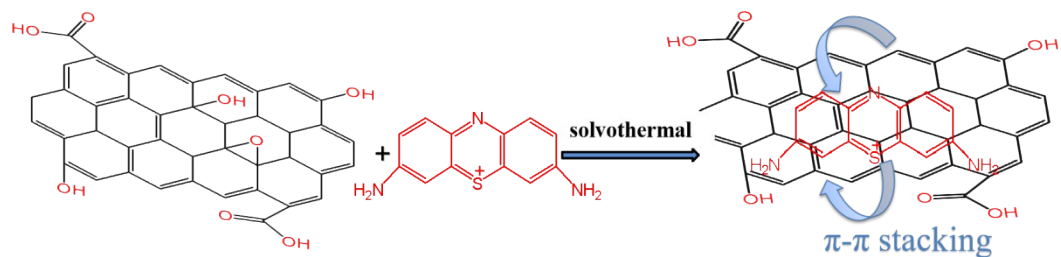


Fig. S4. Schematic illustration for the synthesis of Th-GH.

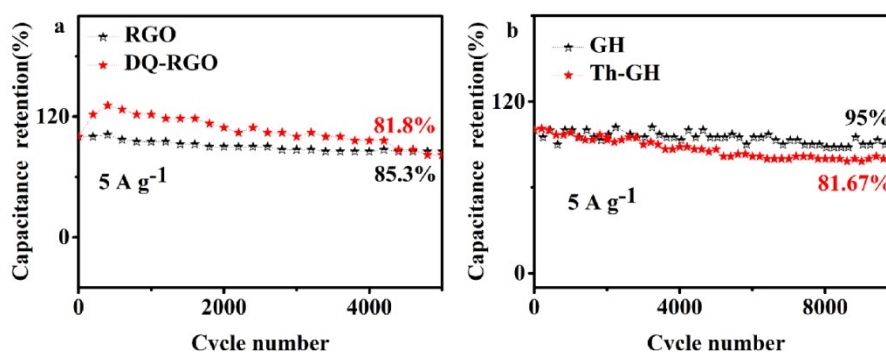


Fig. S5. (a) The cycling stability of RGO and DQ-RGO; (b) The cycling stability of GH and Th-GH

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