Electronic Supplementary Information (ESI) for:

High-performance supercapacitor electrode based on graphene hydrogel modified with 2-aminoanthraquinone moieties

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Table S1 Elemental analysis results of AQGO, AQrG and AQSGH

Sample	C wt%	H wt%	N wt%
AQGO	52.02	1.99	1.10
AQrG [a]	77.12	1.48	1.44
AQSGH [b]	78.85	0.92	1.00

a: reduced by $NaBH_4$.

b: dried sample

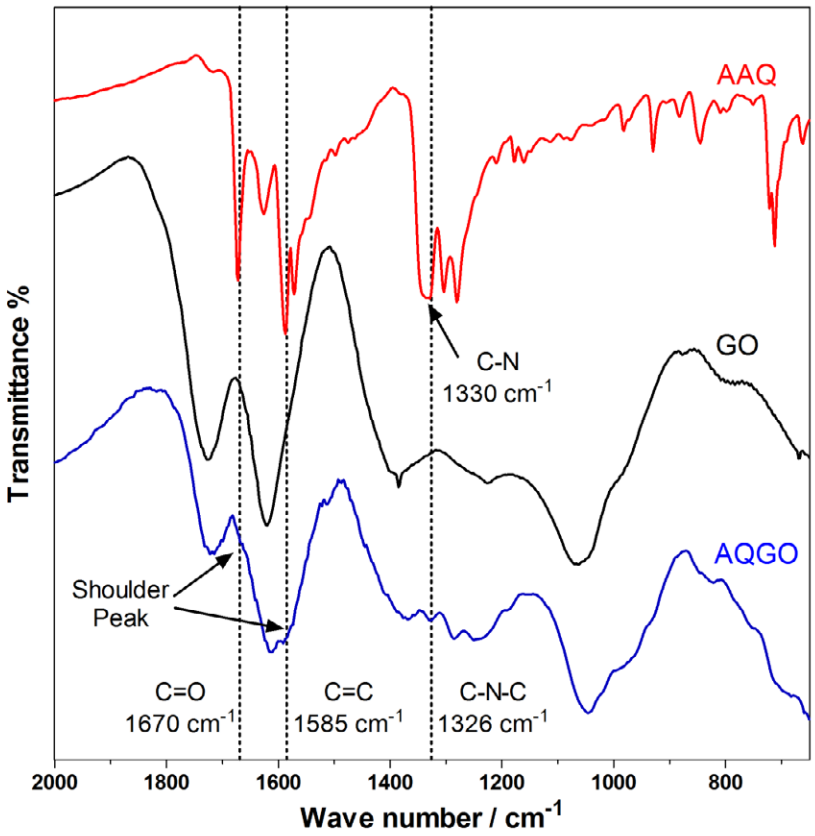

Fig. S1 FTIR spectra of AAQ, GO and AQGO.

The absorption peaks of AAQ at 1670 and 1585 cm^{-1} in the spectrum of AQGO are partly covered by the strong absorption of GO and they are appeared as shoulder peaks. The C–N peak at 1330 cm^{-1} in the spectrum of AAQ is red shifted to 1326 cm^{-1} in the spectrum of AQGO, suggesting the formation of C–NH–C bonds.

Fig. S2 Photographs of the dispersions of AQGO (left) and AQrG (right, reduced by hydrazine) in H_2O/EtOH mixtures (1:1 v/v), the concentration of AQGO or AQrG = 0.3 mg/mL.

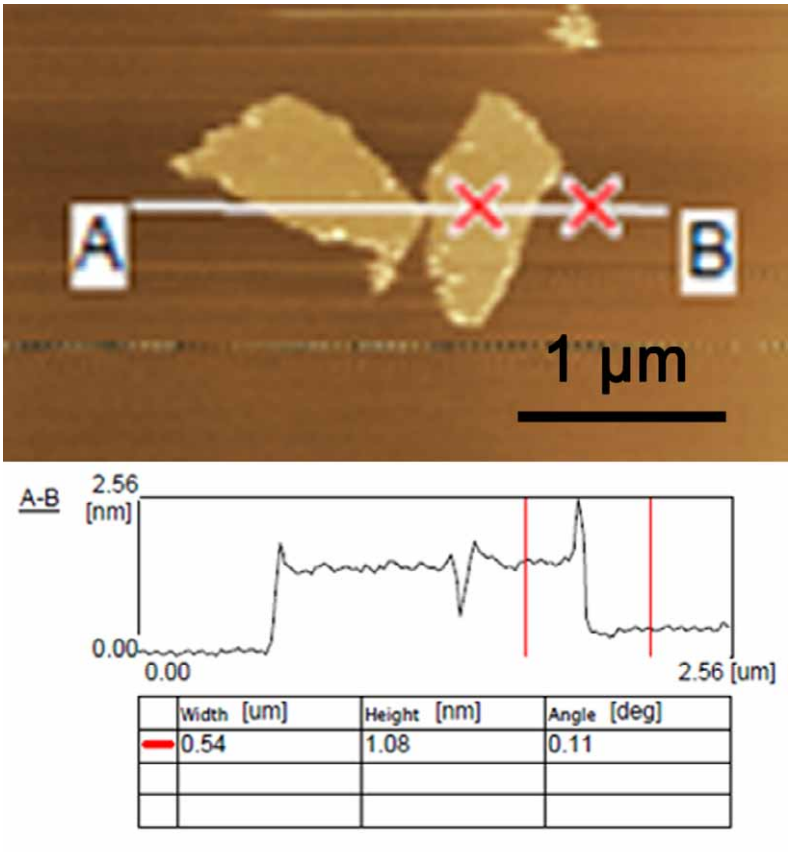

Fig. S3 AFM image and height profile of AQrG sheets dropped from its dispersion (Fig. S2) on mica. The thickness of the AQrG sheet is about 1.08 nm.

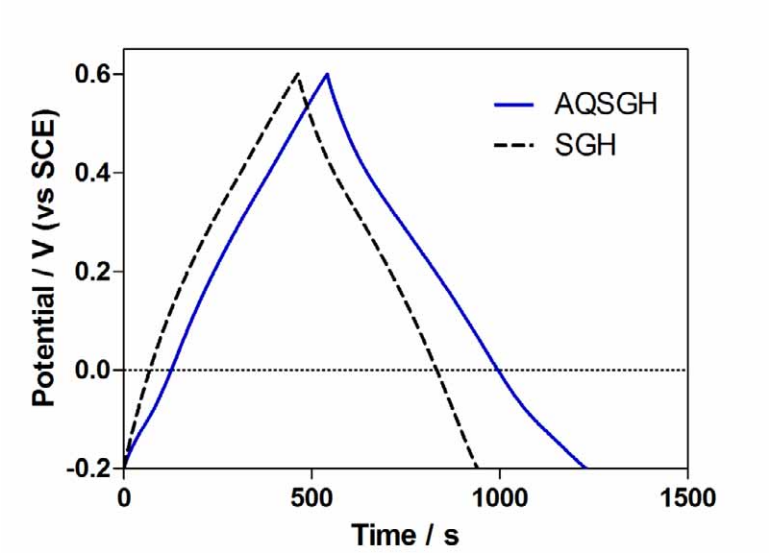

Fig. S4 Galvanostatic charge/discharge curves of AQSGH and SGH at i_d = 0.3 A/g.

Modified methylene blue (MB) adsorption method used for measuring the SSA of AQSGH

MB adsorption is a standard method for measuring the specific surface area (SSA) of graphitic materials. However, the standard MB method is designed for powdery materials. To measure the SSA of AQSGH, this method was modified as follows.

MB aqueous solution (1.5 mg/mL) was used as a standard probe for adsorption and collecting the working curve. Compared with typical MB method, we made two modifications. First, the water contained in the hydrogel will dilute the standard MB solution during the adsorption test; therefore, the actual MB concentration should be corrected. Since AQSGH contains > 97 % water, the volume of the water contained in the hydrogel is nearly equal to the total volume of the hydrogel, which can be measured by the water drainage method. Second, the mass AQSGH has to be

measured after adsorption and drying. In this case, the hydrogel not only adsorbed some MB, but also hold the equilibrium MB solution. These two proportions of MB must be excluded when measuring the mass of AQSGH.

Experimentally, an AQSGH (1.81 cm^3 in size) was immersed in 10.00 mL MB solution for 1 week at room temperature to allow adequate adsorption. Then, 0.50 mL adsorption equilibrium solution was diluted to 100.00 mL. By measuring the light adsorption of diluted solution at 633 nm (measured on a U-3010 UV-VIS spectrometer, Hitachi), we can calculate the concentration of the adsorption equilibrium solution from the working curve. Finally, the AQSGH was taken out from MB equilibrium solution and weighted after drying at 105 °C overnight.

The specific surface area was calculated by the following equation:

$$SSA = 2.54 \times M_3 / (M_1 - M_2 - M_3)$$

The constant 2.54 is the literature value of CMG surface (m^2) covered per mg of MB adsorbed;[1] M_1 is the weight of the AQSGH sample dried from its wet state after adsorption; $M_2 = C \times V$, is the weight of MB in the equilibrium solution hold in the AQSGH sample; $M_3 = 15 - C \times (10 + V)$, is the weight of MB adsorbed by the AQSGH sample; C is the concentration of the adsorption equilibrium MB solution; and V is the volume of the AQSGH sample.

Reference:

1. M. J. McAllister; J. L. Li; D. H. Adamson; H. C. Schniepp; A. A. Abdala; J. Liu; M. Herrera-Alonso; D. L. Milius; R. Car; R. K. Prud'homme; I. A. Aksay, *Chem Mater,* 2007, **19**, 4396-4404.