

Supporting Information

S1 Experimental details

S1.1 Reagents and specifications

Experimental reagents and specifications in the following table.

Table 1 Name and specification of the reagent

Reagent	Specification	Place of production
Potassium hydroxide	AR	Chinasun Specialty Products Co.,Ltd
Ammonia	(NH ₃)W%: 25-28	Laiyang Kangde Chemical Co.,Ltd
hydrazine hydrate	AR	Tianjin BASF Chemical Co.,Ltd
Phenylhydrazine	AR	Sinopharm Chemical Reagent Co.,Ltd
Sodiumborohydride		
Glucose	AR	Tianjin Kemiou Chemical Reagent R & D Center
Ethylene glycol	AR	Tianjin Fuyu Fine Chemical Co., Ltd.

S1.2 Equipment

Electrostatic spinning machine : DFS-001, Beijing Highvoltage Technology Co., Ltd.

S1.3 Experimental Methods

1) Preparation of graphene by hydrazine hydrate : 1g freeze-dried graphite oxide are well pulverized and dispersed in 1000ml of deionized water, ultrasonic dispersion for 1h in the condition of 32 HZ. Respectively, with ammonia and aqueous potassium hydroxide adjust graphene oxide (GO) solution to Ph = 10, continuing ultrasound for 1 hour in weakly alkaline conditions. Under the effect of Ultrasound and electrostatic repulsion, lamellar graphite oxide generating layer-layer peeled off to obtain graphene oxide. 1 ml hydrazine hydrate solution was added in the solution ultrasonic 5 min, to make graphene oxide and hydrazine hydrate contact fully. The prepared graphene oxide solution was poured into 2000ml of three-necked flask, stirred in oil bath and temperature was raised to 105 °C, reflux condenser for 2h during the reaction.

Solution was filtered after the reaction, washed several times with deionized water. the washed solid graphene was dried under vacuum, and part of the dried solid graphene was dispersed in deionized water under ultrasound conditions to get graphene dispersion solution.

2) Preparation of graphene using the phenylhydrazine: Preparation of graphene oxide solution same as above, 1ml and 2ml phenylhydrazine solution were added dropwise to the solution respectively. After ultrasound 5min, the prepared graphene oxide solution was poured into 2000ml of three-necked flask, stirred in oil bath and temperature was raised to 105 °C, reflux condenser for 2h during the reaction. After completion of the reaction, filtering, washing and sample preparation procedure same as above.

3) Preparation of graphene using Sodium borohydride: 1g solid sodium borohydride was added to 1g of graphite oxide solution. Preparation of graphene oxide, high-temperature reaction conditions and centrifugation ,washing and sample preparation procedure same as above.

4) Preparation of graphene with glucose: 5g and 10g of glucose powders were added into 1g graphene oxide solution prepared by graphite oxide dispersion. High-temperature reaction conditions and centrifugation ,washing and sample preparation procedure same as above.

5) Preparation of graphene with ethylene glycol: Preparation of graphene oxide solution same as above, 10mL of graphene oxide colloidal suspension as prepared above was added to a 500mL round bottom flask , then add appropriate amount of ethylene glycol, the mixture with a magnetic tiring 30min at 50 °C, then the mixture was reacted in an oil bath at 100°C for 4.5h, and during the reaction constant magnetic stirring is needed and Nitrogen protection. After the reaction, we obtain a black sheet-like material(insoluble), cooled to room temperature, the supernatant was discarded, and washed and centrifuged for four times by anhydrous ethanol and deionized water respectively, then the washed graphene was saved in ethanol for backup.

N, N-dimethylformamide as the solvent to strip graphite oxide under ultrasonic dispersing condition to prepare graphene oxide solution, then Polyacrylonitrile (m (DMF): m (PAN) = 22:3) was added with ultrasonics tiring, the graphene oxide dispersed homogeneously in polyacrylonitrile solution. Using multi-layer electrostatic spinning machine spinning the solution, fabricate graphite oxide/polyacrylonitrile composite materials. Clipping part of the spinning sample by use of hydrazine hydrate and hydrazine vapor reduction to prepare graphene/PAN composite materials. Similarly, using ethanol as a solvent to dissolve graphite oxide, adding poly(vinylpyrrolidone) (content8wt%) after ultrasonics tripping to get fully dissolved solution, then using electrostatics pinning machine to spinning, and we can fabricate graphene/poly(vinylpyrrolidone) composite material.

S1.4 Analysis instruments and testing methods

1) Transmission electron microscopy (TEM)

For the preparation of TEM samples, graphene suspension prepared from different reducing agents above which were subjected to ultrasonic oscillation were drop casted onto lacey carbon coated copper grids and allowed to dry. The TEM was performed on a JEOL TEM-1200EX microscope.

2) Scanning electron microscopy (SEM)

A small amount of the polished vacuum-dried solid graphene were taped on the glass slide coated with gold. The SEM studies were performed on a JEOL JSM-6390LV microscope. While the graphene spin-coated onto the glass slides dried naturally and sprayed with gold to observe its morphology.

3) IR spectra (FT-IR)

Using the method of KBr pellets, polishing the mixture of the potassium bromide and graphene powders uniformly, then tableting sample, the studies were performed on a Nicolet, USA MAGNA-IR 550 for scanning, with a resolution of 4cm^{-1} , the scans number of 16, the scanning Range $400 - 4000\text{cm}^{-1}$.

4) X-Ray Diffraction (XRD)

The sufficiently pulverized and dried graphene samples was investigated by XRD using a Bruke German D-8 Advance diffractometer with Cu /graphite target, the scanning speed $2^\circ/\text{min}$, scanning range $2^\circ \sim 50^\circ$.

5) Ultraviolet analysis

Aqueous dispersion of graphene was investigated by the UV-visible spectrophotometer using a UV755B instrument made in Shanghai Youke Co., Ltd.

6) Elemental analysis

According to the test above ,the elemental composition of graphite oxide (wt%) is: Carbon 59.33%, oxygen 35.16%, hydrogen 1.99%, impurities 3.52%, carbon to oxygen atomic ratio $C/O=2.25$; the elemental composition of graphene (wt%) is: carbon 82.74%, oxygen 10.57%, hydrogen 2.15%, nitrogen 1.47%, $C/O =10.44$. The reduction of graphite oxide by hydrazine hydrate to generate carbon to oxygen ratio 10.44. Nitrogen element still came from the reducing agent which was caused by the reaction of hydrazine hydrate and the carbonyl group of graphite oxide.