

Electronic supplementary information

Superior dispersions of reduced graphene oxide synthesized by using gallic acid as reductant and stabilizer

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1. Synthesis of Graphite Oxide

Graphite oxide was synthesized from graphite powder by a modified Hummers method.^{1,2} The preparation procedure includes two steps: pre-oxidation and full oxidation. In the initial step, $K_2S_2O_8$ (8.4 g), P_2O_5 (8.4 g) and concentrated H_2SO_4 (50 ml) were stirred together in a 250 mL round-bottom flask until all the reactants were completely dissolved. The solution was then cooled to 80 °C. Graphite powder (10 g) was added to the H_2SO_4 solution, stirring vigorously at 80 °C for 4.5 h. After adding 100 mL of DI water at ~1 mL/s, the suspension was transferred to a 500 mL beaker and left overnight. Then the mixture was filtered through a 0.22 μm Nylon Millipore membrane, washed with deionized water, and then transferred to a dish. The pre-oxidized graphite was dried in air for two days.

In the second step, concentrated H_2SO_4 (95 ml) was put into a 500 mL three-necked round bottom flask and cooled to 0 °C by an ice bath. The above pre-oxidized graphite was added to the H_2SO_4 solution and kept stirring. Subsequently, $KMnO_4$ (10 g) was added slowly enough so as to make the temperature remain below 10 °C. It took nearly 2 hours to add all the $KMnO_4$ to the mixture. The mixture was held at 35 °C for 2 hours. Then deionized water (184 mL) was added to the mixture under stirring at about 1 mL/s, keeping the temperature below 50 °C. The reddish brown suspension was transferred to a 1 L beaker and diluted with 420 ml of deionized water, and then 7.5 mL of 30% H_2O_2 was added to the suspension. The brilliant yellow mixture was allowed to settle for one day. The clear supernatant was

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decanted and the residual mixture was centrifuge at 9000 rpm. Then the precipitates were washed with 500 mL of 10% HCl solution and another 1 L of deionized water was added to remove the acid. The thick suspension was put into several dialysis bags (Mn = 3500) and dialyzed for two weeks to remove residual acid and metal ions. Finally, the result suspension was dehydrated through rotary evaporation under reduced pressure. The as-synthesized graphite oxide was dried *in vacuo* at 50 °C for 48 h.

2. Determination of the dispersibility of rGO

The rGO samples for the measurement of dispersibility were dried for 3 hours at room temperature. The dispersibility of rGO was tested in the following solvents: deionized water, acetone, methanol, ethanol, ethylacetate, tetrahydrofuran (THF), *N,N'*-dimethylformamide (DMF), *N*-methyl-2-pyrrolidone (NMP) and dimethylsulfoxide (DMSO). Typically, a certain amount of the as-synthesized rGO was added to 4 mL solvent and sonicated for 2 h. If it well dispersed, a greater amount of rGO was added to another 4 mL solvent and sonicated for 2 h so as to determine whether it could disperse completely or not. The dispersible amount of rGO could be indicated when there is a very small part of precipitate in the suspension after sonication for 2 h. In other words, the last weight but one is the dispersible amount of rGO. On the other hand, the percent of the dry rGO in the as-synthesized rGO was obtained by measuring the weight before and after drying at 50 °C for 24 h. The dispersibility of the dry rGO thus could be deduced.

References:

1. W. S. Hummers Jr. and R. E Offeman, *J. Am. Chem. Soc.*, 1958, **80**, 1339.
2. Z. Xu and C. Gao, *Macromolecules*, 2010, **43**, 6716.