Electronic Supplementary Information

A facile green strategy for rapid reduction of graphene oxide by metallic zinc

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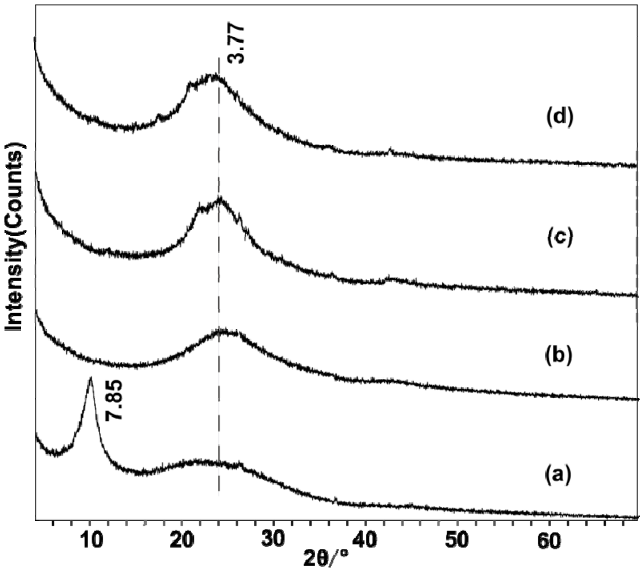

Fig. S1 XRD patterns of GO-NaOH-RT (a), GO-NaOH-100 (b), GO-Zn-RT (c) and GO-Zn-100 (d), respectively**.** The *d*-value is in Å.

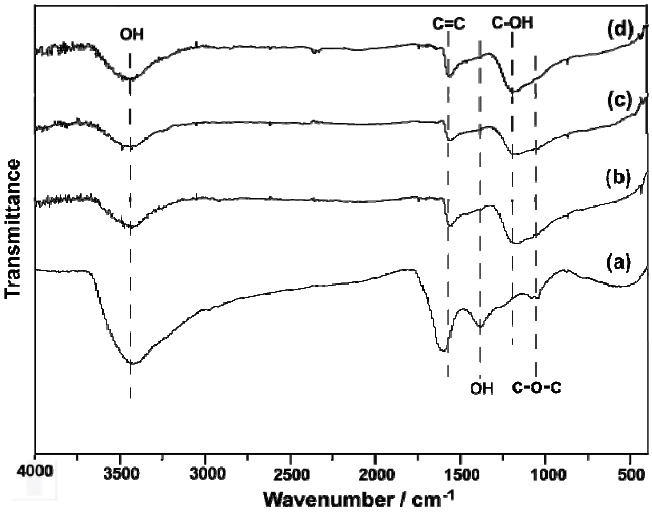

Fig. S2 FT-IR spectra of GO-NaOH-RT (a), GO-NaOH-100 (b), GO-Zn-RT (c) and GO-Zn-100 (d), respectively.

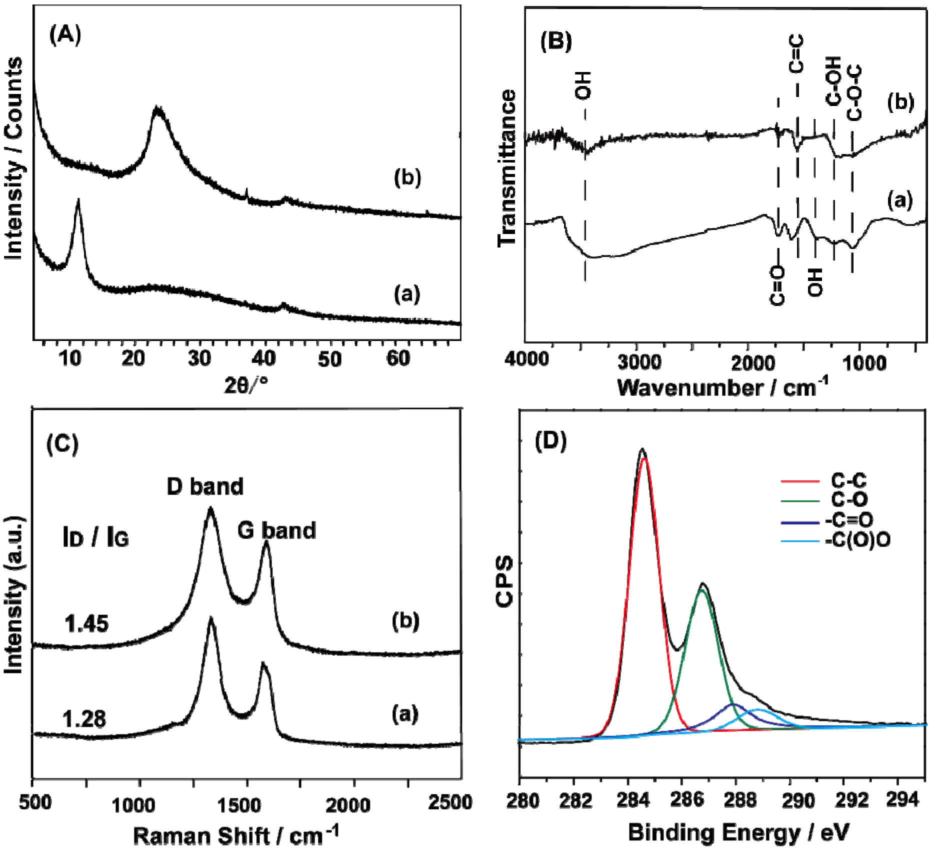

Fig. S3 Control study on the reduction of GO in acidic media (HCl, 1M) at RT and 100 ºC, rGO-HCl-RT and rGO-HCl-100 were confirmed by XRD pattern (A), FT-IR (B) and Raman (C) spectra, respectively. (D) is the XPS spectrum of rGO-HCl-100.

We also reduced GO in HCl (1 M) solution at room temperature and 100ºC for control experiments, powder of 0.01 M Zn and 0.06 M HCl were added into GO dispersion (0.5 g/L, 60 mL), and the products were donated as rGO-HCl-RT and rGO-HCl-100. A board diffraction peak at about 25º indicates that reduction has taken place at 100 ºC and some oxygen-containing groups (ie. carboxyl and epoxy) are removed. According to Raman spectra, rGO-HCl-100 becomes more defective than that of rGO-HCl-RT. However, XPS analysis shows that some oxide groups are still retained and the calculated C/O ratio is 3.06, indicating a low reduction extent of rGO-HCl-100.

This can be clarified as follows. In 1 mol/L of HCl solution, the pH value of the solution is 0.18, well-dispersed GO sheets trend to form agglomeration,[1] They are apt to be captured by the rising hydrogen bubbles and then float to the water surface due to their amphiphilicity,[2] thus, GO cannot get fully in touch with Zn powder though constant stirring is provided. In addition, the fast reaction rate of Zn powder with HCl acid results in a rapid consumption of Zn. While in 100 ºC, as a strong Lewis acid, zinc chloride is known to catalyze the dehydration of alcohols and activate aromatic nucleus.[3,4] Chemisorbed hydrogen has been noticed to open epoxy and reduce hydroxyl on GO,[5] that is, generated hydrogen in the solution will also contribute to the reduction.

The mechanism is quite different from that in NaOH solution, it deserves to be noticed.

References

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