Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting information for

Supercapacitor with High Capacitance Based on Reduced Graphene Oxide/Carbon Nanotubes/NiO Composite Electrode

Yang Bai, Meng Du, Jie Chang, Jing Sun*, and Lian Gao

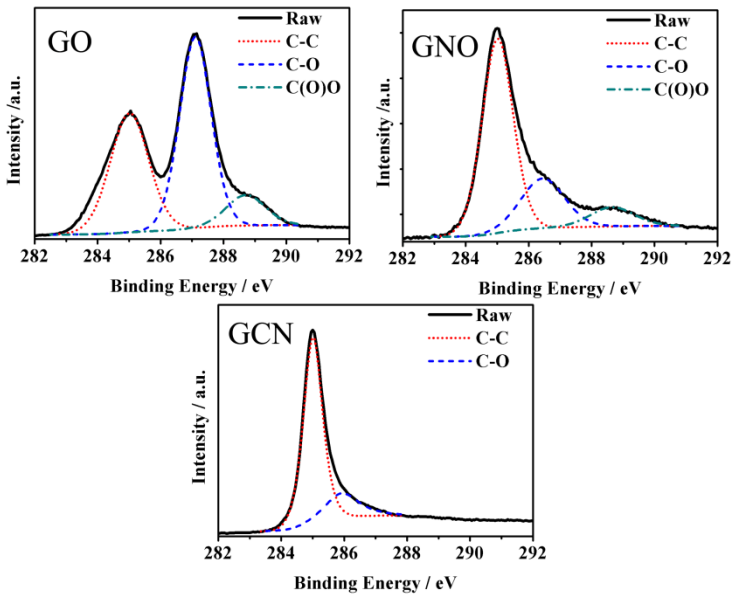

Fig. S1 The XPS spectrum of C 1s for GO, GNO, and GCN.

Table S1 XPS data of GO, GNO, and GCN.

	GO		**GNO**		**GCN**	
Bond	Peak BE (eV)	At. %	Peak BE (eV)	At. %	Peak BE (eV)	At. %
C-C	**285.0**	**50.10**	**285.0**	**66.65**	**285.0**	**80.29**
C-O	**287.0**	**38.16**	**286.5**	**24.04**	**286.1**	**19.71**
C(O)O	**288.7**	**12.74**	**288.7**	**9.31**	**—**	**—**

Further examination with XPS illustrates the reduction degree of RGO (Fig. S1). The divided peaks of C 1s centered at 285.0, 286.5, and 288.7 eV are attributed to the nonoxygenated ring C (C-C), carbonyl carbon (C-O), and carboxylate carbon (C(O)O), respectively.[1-3] The absorbance band intensities of C-O and C(O)O in GO are much higher than those of GNO and GCN, indicating the high oxidation degree of GO. After reduction, oxygen-containing functional groups are removed. The intensities of C-O and C(O)O become much weaker in GNO and GCN. The C(O)O peak even disappears in GCN. The ratio of C-C increases form 66.65 % to 80.29 % when CNTs were added into the composites (Table S1). At the same time, the ratios of C-O and C(O)O in GCN drop to 19.71 % and 0 from 24.04 % and 9.31 % in GNO, respectively, indicating that residual oxygen-containing functional groups in GCN are lower than those of GNO. In addition, according the XRD results, the peak of GO does disappear in GCN. The reduction degree of RGO in GCN is enhanced in comparison with GNO.

It is probably due to the aggregation being avoided successfully, and GO disperses well in solution and contacts with urea adequately. Then the reduction reaction of GO would be more sufficient. Thus, the conductivity of GCN is surely better than GNO because of less oxygen-containing functional groups existing.

References

1. G. Sobon, J. Sotor, J. Jagiello, R. Kozinski, M. Zdrojek, M. Holdynski, P. Paletko, J. Boguslawski, L. Lipinska and K. M. Abramski, *Opt Express*, 2012, 20, 19463-19473.
2. H. Li, G. Zhu, Z.-H. Liu, Z. Yang and Z. Wang, *Carbon*, 2010, 48, 4391-4396.
3. X. Xia, J. Tu, Y. Mai, R. Chen, X. Wang, C. Gu and X. Zhao, *Chemistry European Journal*, 2011, 17, 10898-10905.