Supporting Information

Room Temperature Production of Graphene Oxide with Thermally-labile Oxygen Functional Groups for Improved Lithium Ion Batteries Fabrication and Performance

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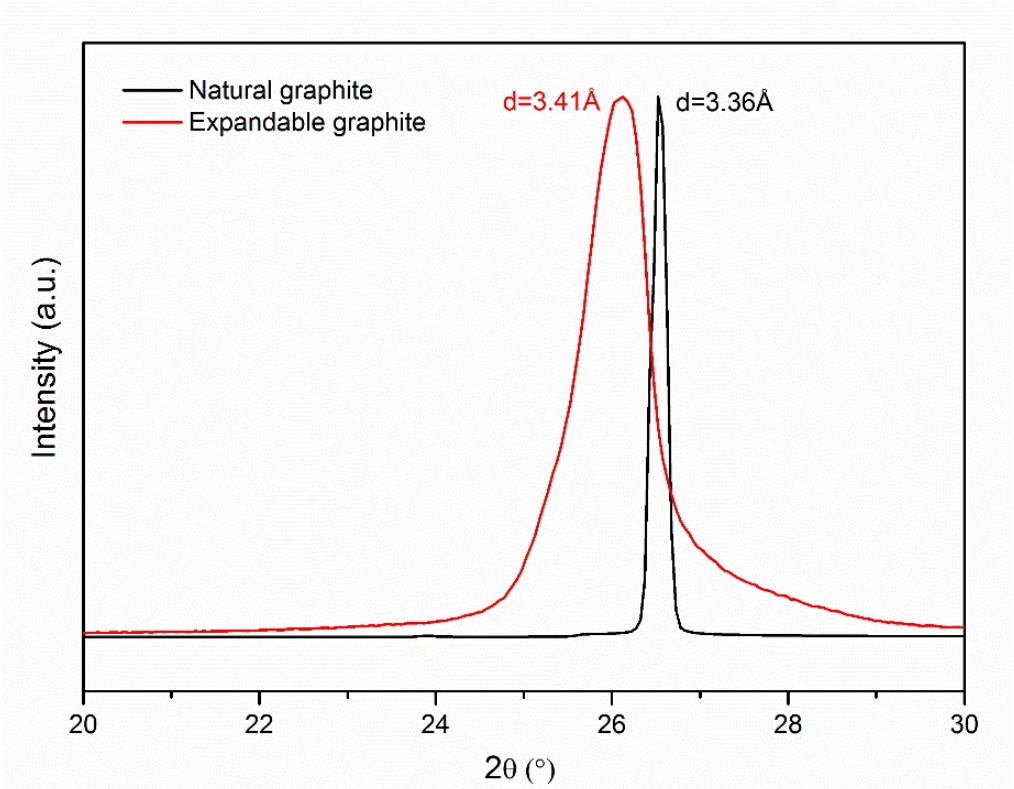

Figure S1. The XRD curves for expandable graphite and natural graphite.

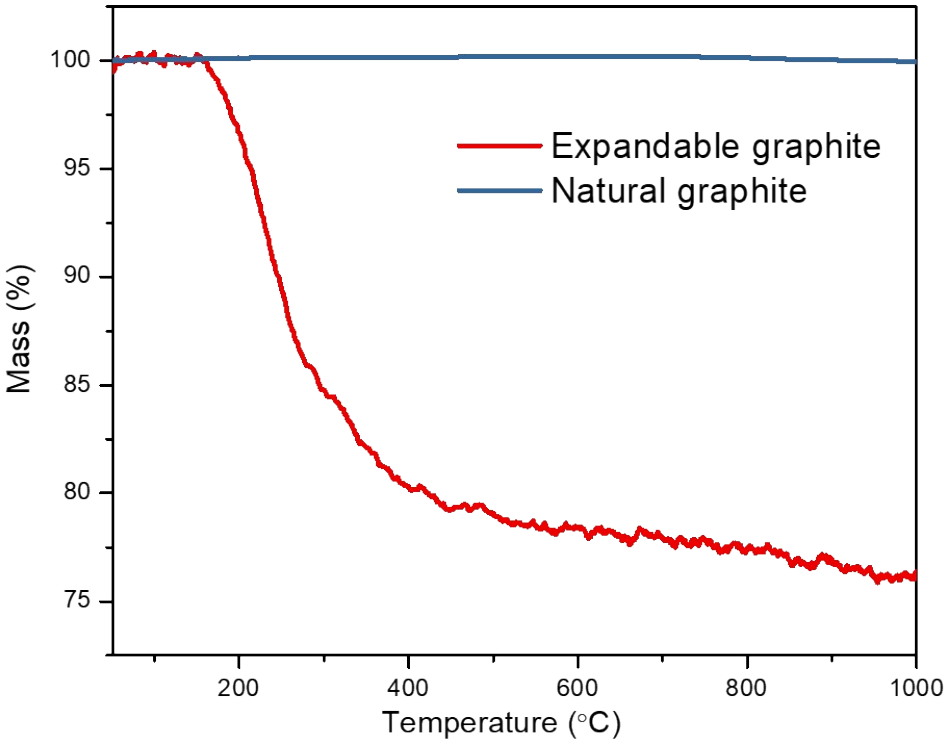

Figure S2. TGA curves of expandable graphite and natural graphite heated from 50 to 1000 °C at the rate of 5 K/min under pure argon atmosphere.

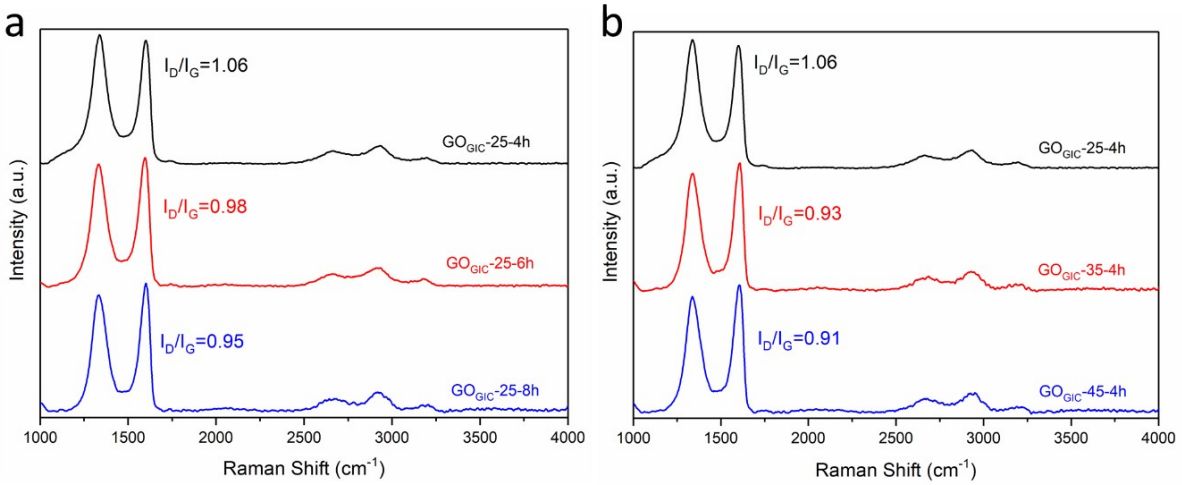

Figure S3. The Raman spectra of GO_{GIC} (a) at the temperature of 25 °C for different time, and (b) at different temperature for 4 h.

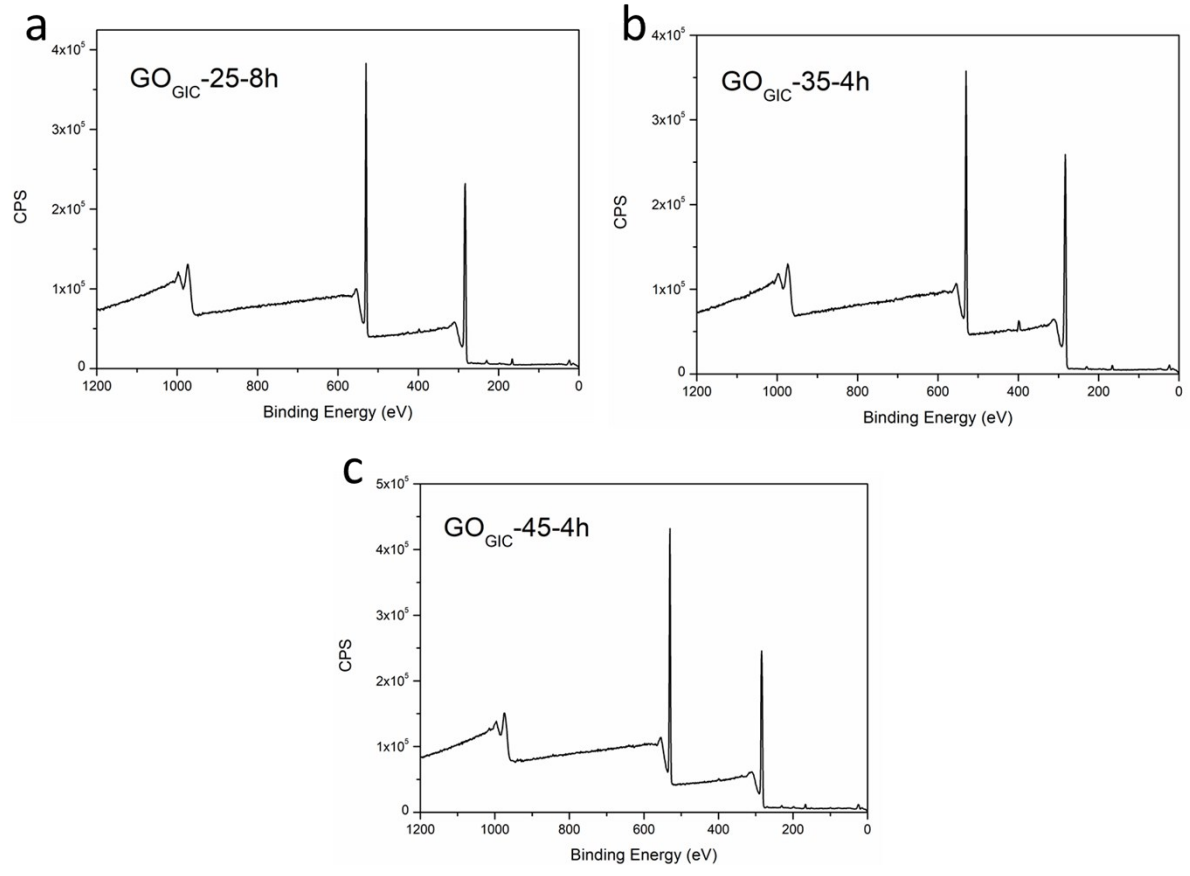

Figure S4. XPS survey spectra for different GO_{GIC} samples. The C/O ratios for GO_{GIC}-25-8h, GO_{GIC}-35-4h and GO_{GIC}-45-4h were 2.68, 3.05 and 2.41, respectively.

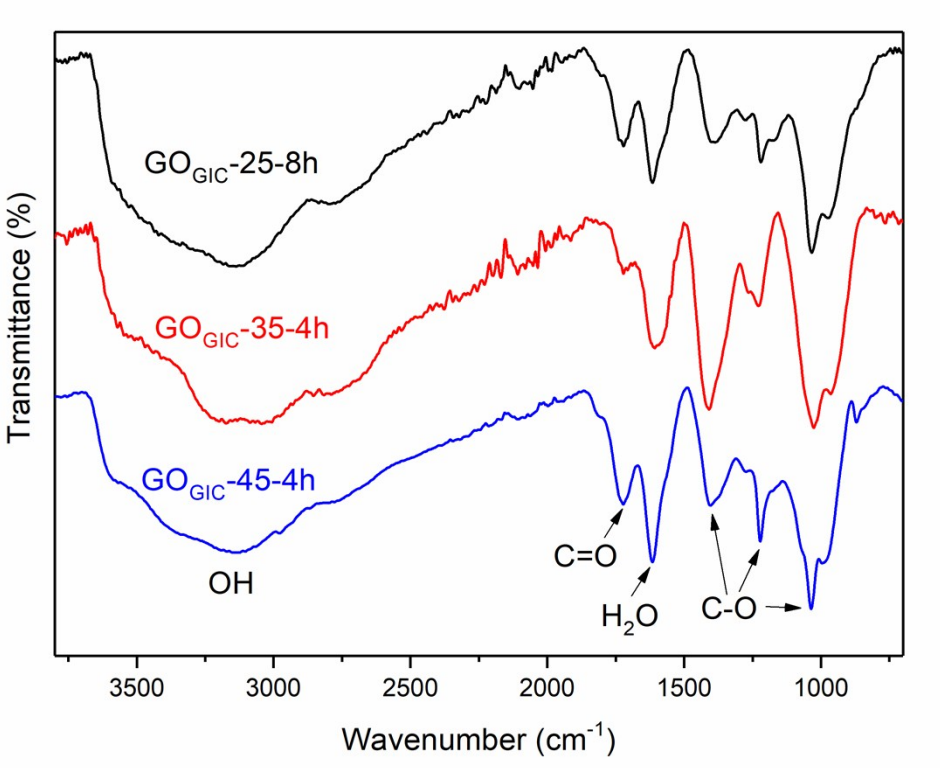

Figure S5. ATR-FTIR spectra for GO_{GIC} films which indicated the presence of C=O (the peak at ~1723 cm^{-1}), C-O (at 1400 and 1225 cm^{-1}) and -OH (3700-2700 cm^{-1}) in GO samples.[1, 2]

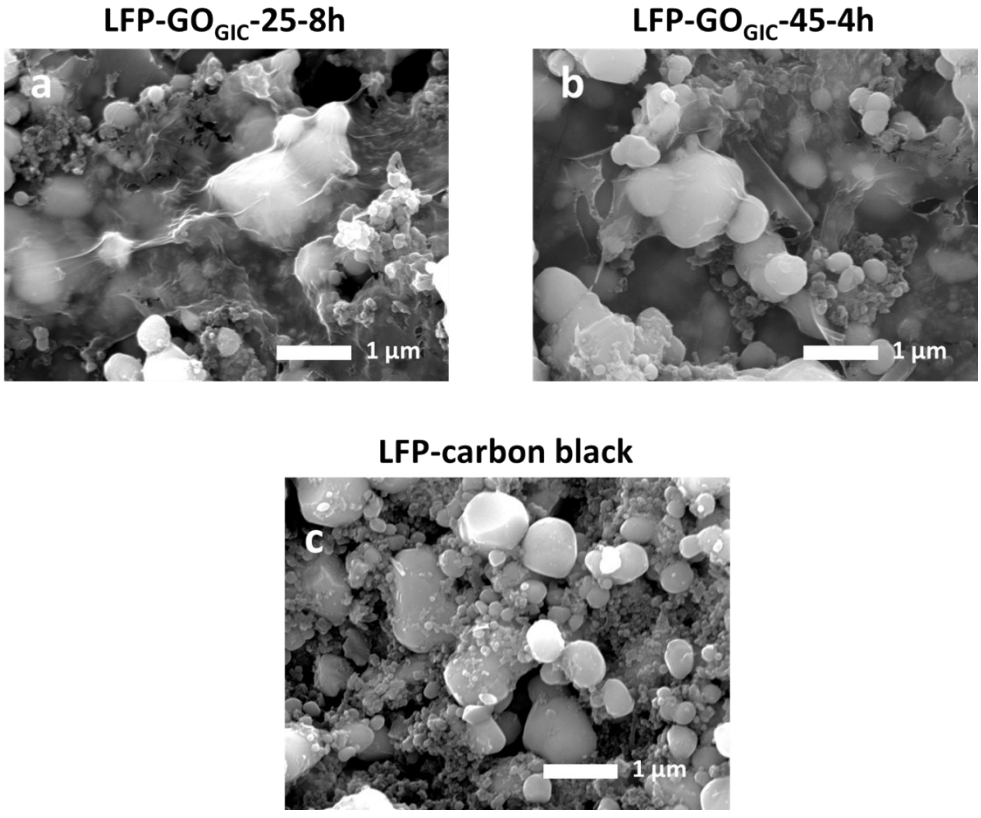

Figure S6. SEM images for GO_{GIC} modified LFP cathodes and unmodified LFP cathode.

Table S1. The residual weight percentage of GO_{GIC} after 6 h of thermal treatment at 150, 175 and 200 °C in 20% O_2/80% Ar atmosphere.

Annealing temperature	150 °C	175 °C	200 °C
GO_{GIC}-25-8h	69 %	66 %	65 %
GO_{GIC}-35-4h	77 %	73 %	70 %
GO_{GIC}-45-4h	72 %	65 %	61 %

Table S2. The atomic percentages of five components in the unreduced GO_{GIC} according to the fitted C1s XPS curves in **Figure 4g-i**.

	GO_{GIC}-25-8h	**GO_{GIC}-35-4h**	**GO_{GIC}-45-4h**
C=C/C-C	48.18%	56.53%	44.79%
C-O	44.43%	35.44%	45.61%
C=O	5.04%	4.81%	6.04%
COOH	2.29%	2.81%	3.49%
π-π*	0.05%	0.41%	0.07%

Table S3. The atomic percentages of five components in the reduced GO_{GIC} after 5 h of 150 °C thermal annealing according to the fitted C1s XPS curves in **Figure 4j-l**.

	rGO_{GIC}-25-8h (150 °C, 5h)	**rGO_{GIC}-35-4h (150 °C, 5h)**	**rGO_{GIC}-45-4h (150 °C, 5h)**
C=C/C-C	72.56%	66.44%	63.83%
C-O	15.01%	20.00%	19.37%
C=O	5.93%	6.21%	9.10%
COOH	4.34%	4.51%	4.95%
π-π*	2.16%	2.84%	1.97%

Table S4. Summary of various rGO modified $LiFePO_4$ cathodes. In the case of pre-reduced GO, GO was reduced first and then mixed with other active materials for the assembly of LIBs.

Surface treatment on LFP particles	Conductive additives	Specific Capacity at 0.1 C rate ($mA{\cdot}h{\cdot}g^{-1}$)	High rate performance ($mA{\cdot}h{\cdot}g^{-1}$)	Capacity Fading Per Cycle (%)	Ref.
No	rGO_{GIC}-25-8h	171 (at 0.1 C)	77 (at 10 C) 54 (at 20 C)	-0.11 (55 cycles at 2 C)	This work
No	rGO_{GIC}-45-4h	166 (at 0.1 C)	45 (at 10 C) 11 (at 20 C)	-0.09 (55 cycles at 2 C)	This work
No	No rGO, carbon black only	152 (at 0.1 C)	36 (at 10 C) 13 (at 20 C)	-0.18 (55 cycles at 2 C)	This work
No	Electrophoretic deposition of GO and LFP particles on carbon cloth followed by annealing at 700 °C	174.7	90 (at 10 C)	-0.0027 (400 cycles at 2 C)	[3]
No	Pre-reduced GO (reduced by hydrazine)	Not provided	87 (at 10 C) 69 (at 20 C)	Not provided	[4]
APS-modified LFP	Reduced GO (co-heated with LFP at 600 °C under Ar/H_2)	Not provided	105 (at 10 C) 70 (at 20 C)	-0.009 (950 cycles at 10 C)	[5]
Carbon coated LFP	Pre-reduced GO (reduced by hydrazine and annealed under N_2/H_2)	152	107 (at 10 C)	0.167 (100 cycles at 0.1 C)	[6]
Hydrothermal synthesized LFP/rGO hybrids	rGO (co-heated with LFP at 700 °C)	166	75 (at 10 C) 60 (at 15 C)	-0.013 (100 cycles at 0.1 C)	[7]

References

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