

Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information

Sustainable and facile synthesis of high-performance nitrogen-doped carbon/graphene@LiFePO₄ cathode materials from spent LiFePO₄

Bo Wang,^{*a,b} Yue Li,^{a,b} Xiaoli Zhu,^a Fengyan Guo,^a Dingpei Zhang,^a and Hui Wang,^c

^a *School of New Materials and Chemical Engineering, Tangshan University, Tangshan 063000, P. R. China.*

^b *Key Laboratory of Fine Chemical industry in Tangshan City, Tangshan University, Tangshan 063000, P. R. China*

^c *HeBei LingDian New Energy Technology Co., Ltd, Tangshan 063000, P. R. China*

* Corresponding author. Tel: +86-315-2010649; Fax: +86-315-2010649.

E-mail address: wangbo@buaa.edu.cn.

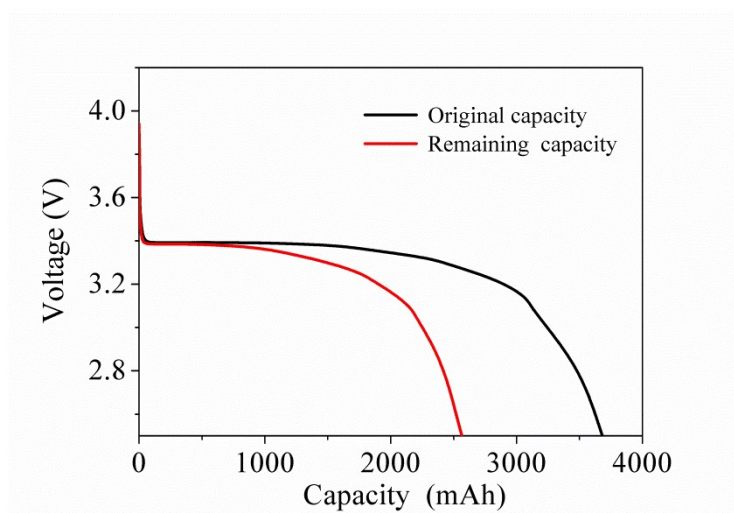


Fig. S1 The remaining and original discharge curves of the 26,650-type spent batteries in the range of 2.5 to 4.2 V at 0.5 C rate. The remaining and original discharge capacities are 2564.86 and 3681.45 mAh, respectively.

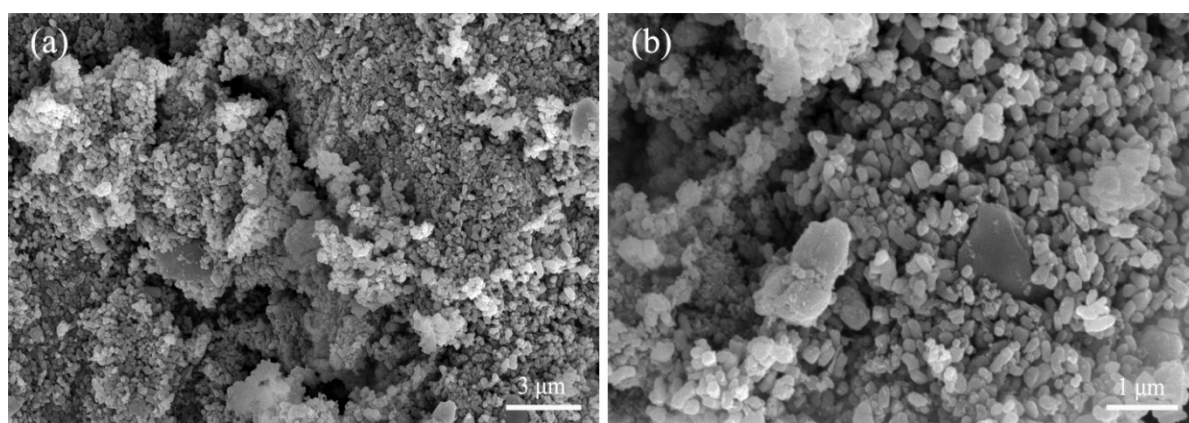


Fig. S2 SEM images of the s-LFP at various magnifications.

Table S1 The elemental composition of the as-synthesized N-DC/G@LPF composites from the EDS (Fig. 2d) .

Element	Weight (%)	Atomic (%)
C	17.92	31.38
O	33.38	43.19
N	1.27	2.38
Fe	30.25	11.39
P	17.18	11.66

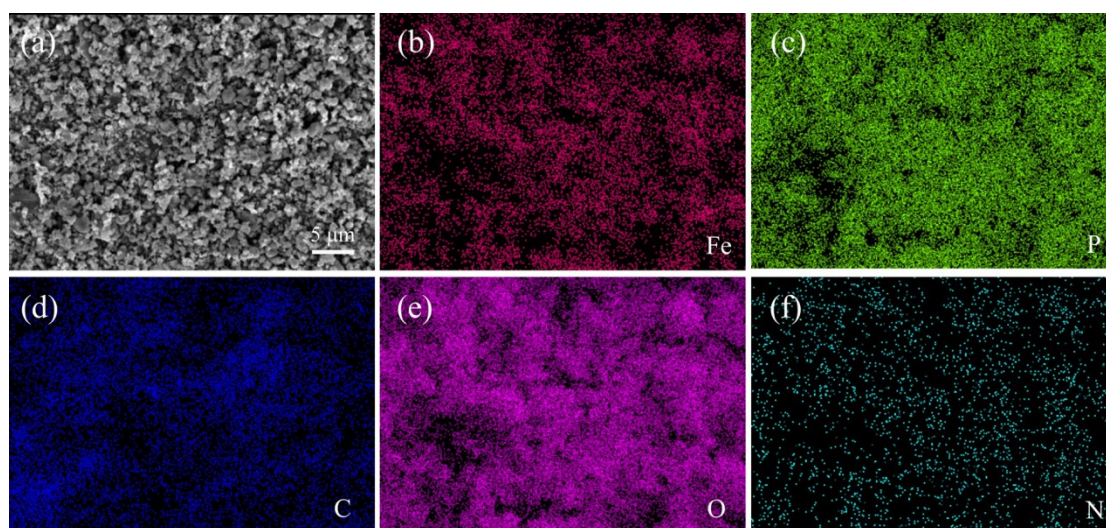


Fig. S3 (a) SEM image of the N-DC/G@LPF composites; corresponding EDX elemental mapping of (b) iron, (c) phosphorus, (d) carbon, (e) oxygen, and (f) nitrogen.

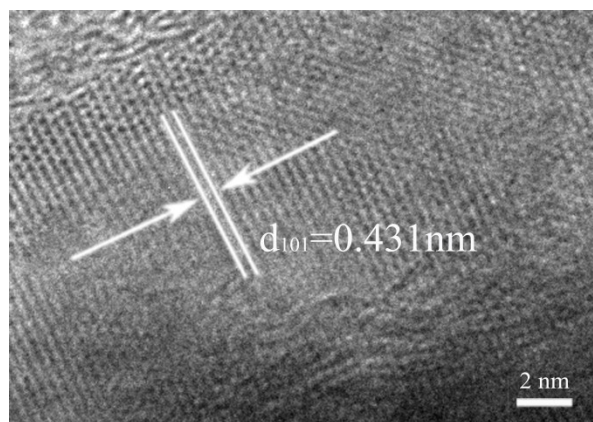


Fig. S4 The partial enlarged HR-TEM images of the N-DC/G@LPF nanocomposites.

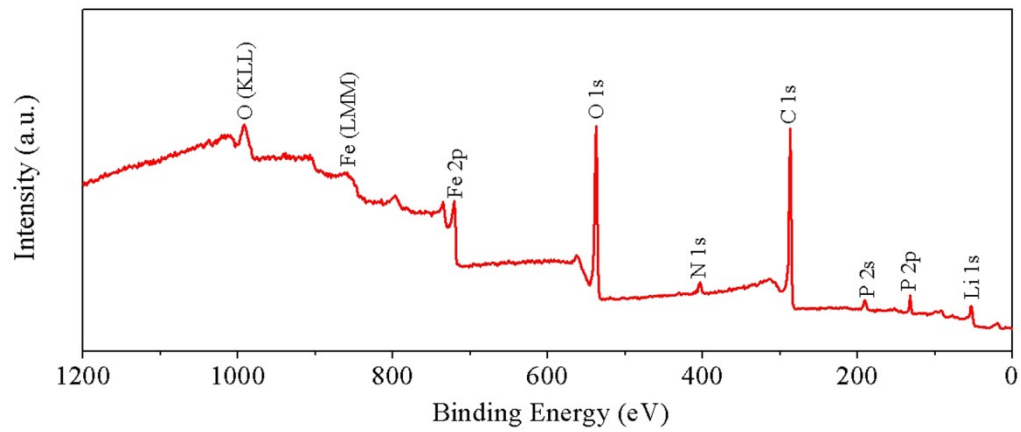


Fig. S5 Full spectrum of XPS survey of N-DC/G@LPF nanocomposites.

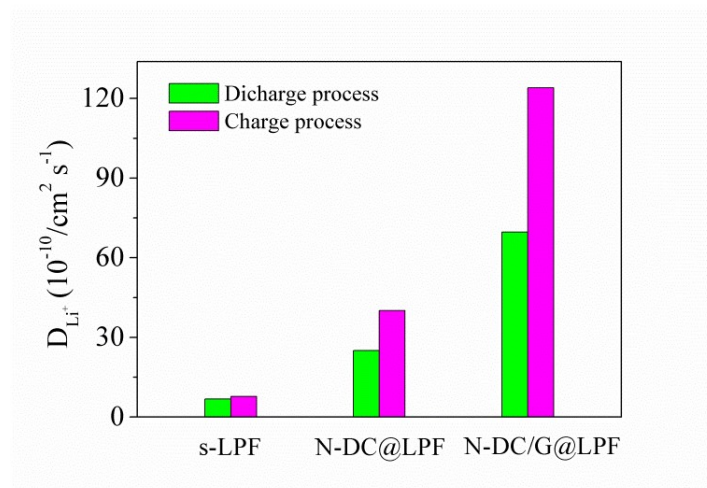


Fig. S6 The Li⁺ ions diffusion coefficients calculated by Randles-Sevcik equation for all electrodes.

Table S2. Comparison of electrochemical performance of the N-DC/G@LFP in this work with some other carbon-coated LFP materials reported in previous literatures.

Type of material	Charge specific capacity (mAh g ⁻¹)	Current density (mA g ⁻¹)	Cycle number (n)	Reference
LFP/C composites	131.5	0.1 C	100	1
S-modified reduced graphene oxide modified LiFePO ₄ /C	~150	0.2 C	100	2
LFP/rGO nanocomposite	128.03	0.1 C	50	3
LFP@ZC composites	151	0.1C	100	4
LiFePO ₄ /C composites	143.5	0.2C	100	5
N-DC/G@LFP cathode materials	149.3	0.2 C	500	This work

References

- 1 X.Y. Liu, R.P. Zhao, Y.J. Xia, Q. Li, *Ionics*, 2022, **28**, 4579-4585.
- 2 Z.-L. Chen, Y.-J. Gu, G.-Y. Luo, Y.-L. Huo and F.-Z. Wu, *Ionics*, 2022, **28**, 191-200.
- 3 E. Suarso, F. A. Setyawan, A. Subhan, M. Mahyiddin Ramli, N. Syakimah Ismail, M. Zainuri, Z. Arifin and Darminto, *J Mater Sci: Mater Electron.*, 2021, **32**, 28297-28306.
- 4 Z. Jiang, S. Li, J. Lu, J. Du, Y. Tao, Y. Cheng and H. Wang, *J. Alloy. Compd.*, 2023, **937**, 168402.
- 5 Q. Sun, X. Li, H. Zhang, D. Song, X. Shi, J. Song, C. Li and L. Zhang, *J. Alloys Compd.*, 2020, **818**, 153292.