Supplementary Information

Porous $CaFe_2O_4$ as a promising lithium ion battery anode: a trade-off between high capacity and long-term stability

Chunhua Han,* Xiao Zhang, Xiaoming Xu, Qi Li, Qiu He, Jiashen Meng, Xuanpeng Wang, Ziang Liu, Peijie Wu and Liqiang Mai*

Prof. C. Han, X. Zhang, Dr. X. Xu, Dr. Q. Li, Q. He, Dr. J. Meng, Dr. X. Wang, Dr. Z. Liu, P. Wu, Prof. L. Mai

State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, International School of Materials Science and Engineering, Wuhan University of Technology, Luoshi Road 122, Wuhan, 430070, Hubei, China

*E-mail: hch5927@whut.edu.cn (Prof. C. H. Han); mlq518@whut.edu.cn (Prof. L. Q. Mai)

‡These authors contributed equally to this work.

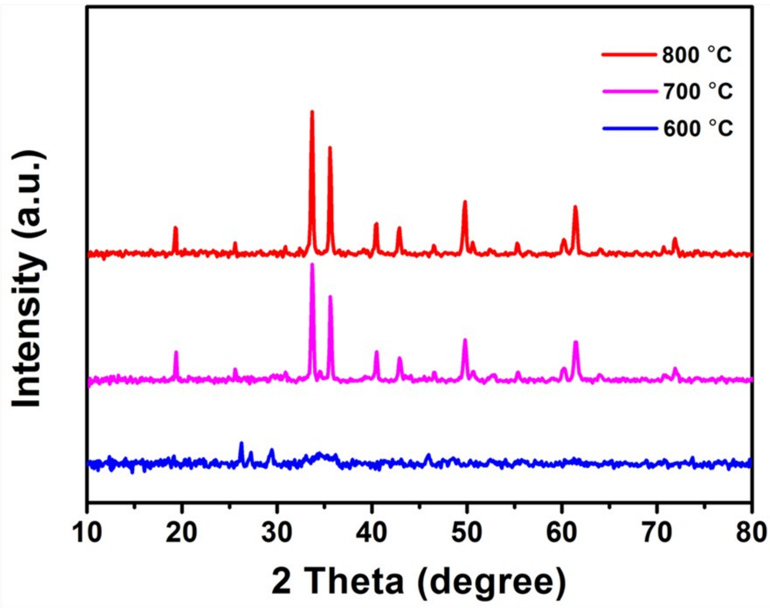

Fig. S1 XRD patterns of the $CaFe_2O_4$ calcined at different temperatures for 5 h in air.

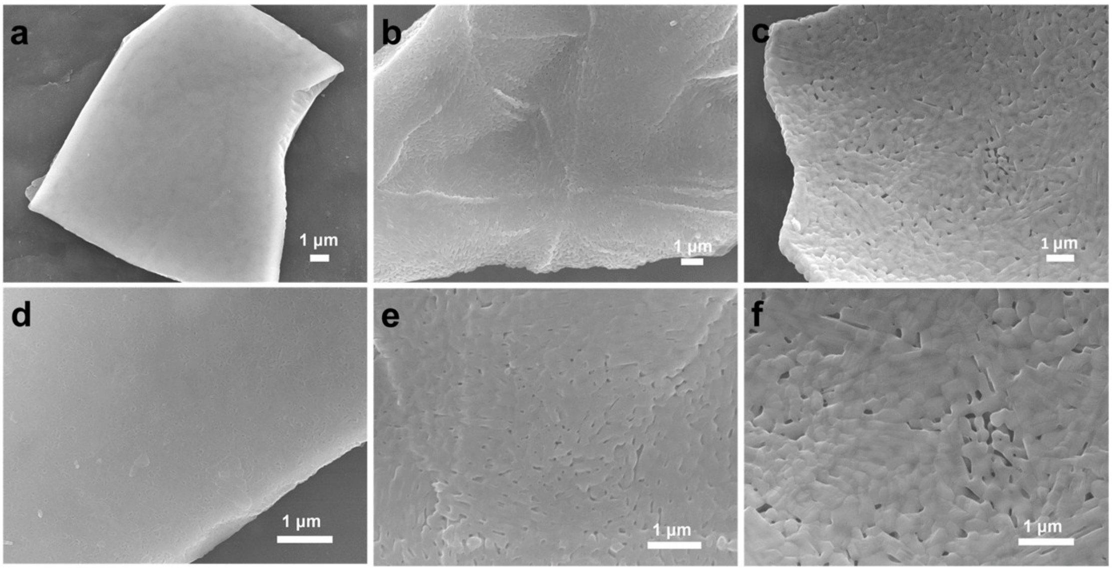

Fig. S2 SEM images of the $CaFe_2O_4$ calcined at 600 °C (a, d), 700 °C (b, e), 800 °C (c, f) for 5 h in air.

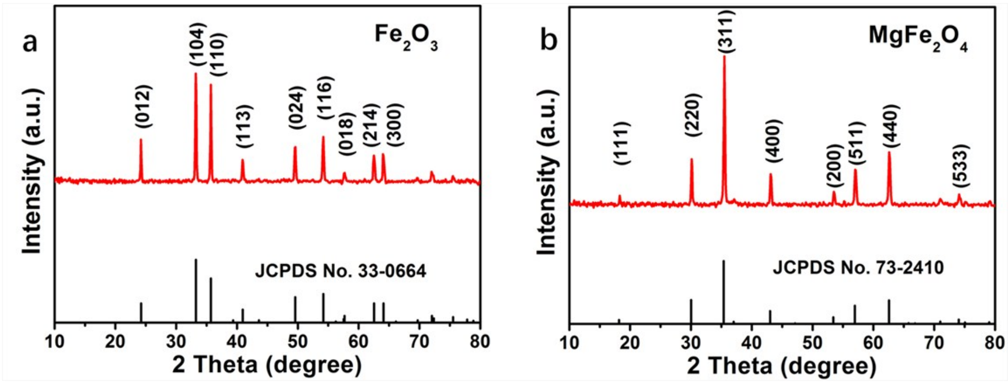

Fig. S3 XRD patterns of the Fe_2O_3 (a) and $MgFe_2O_4$ (b) calcined at 800 °C for 5 h in air.

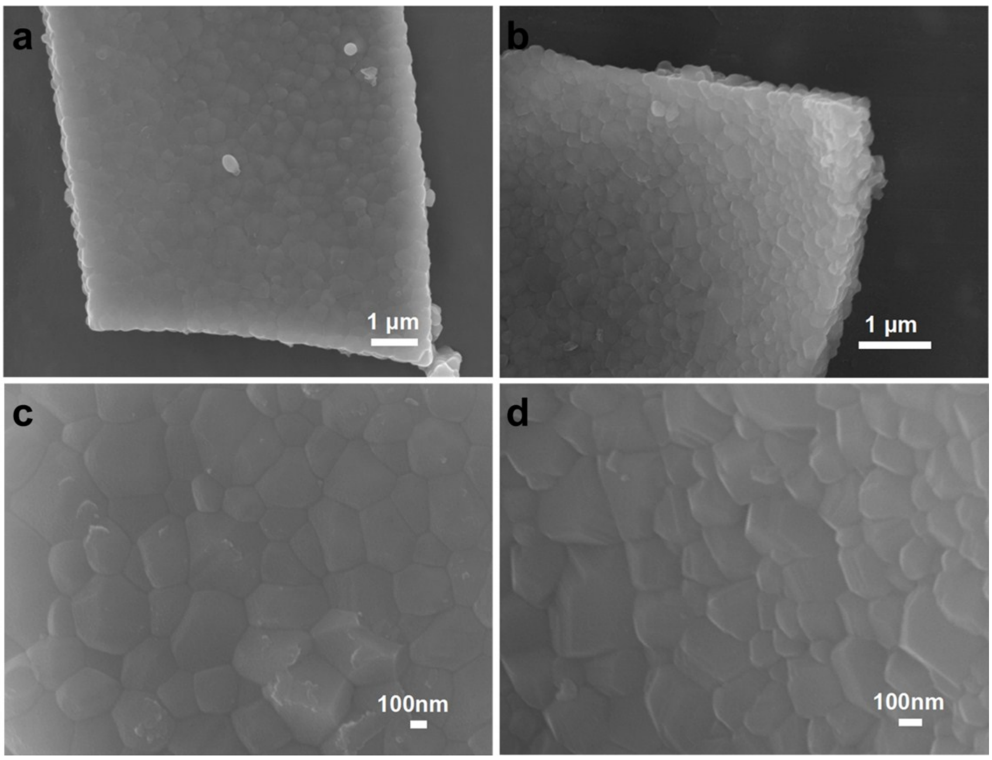

Fig. S4 SEM images of the Fe_2O_3 (a, c) and $MgFe_2O_4$ (b, d) calcined at 800 °C for 5 h in air.

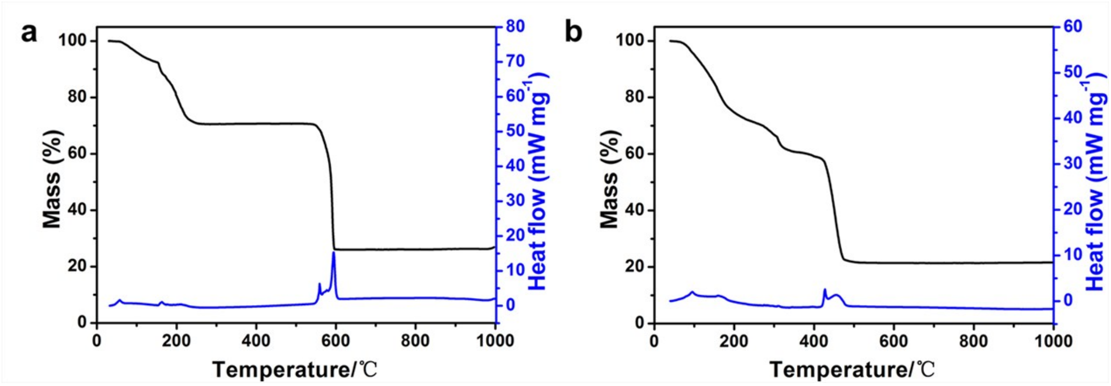

Fig. S5 TGA and DSC curves of the commercial $Ca(NO_3)_2 \cdot 4H_2O$ (a) and $Mg(NO_3)_2 \cdot 6H_2O$ (b).

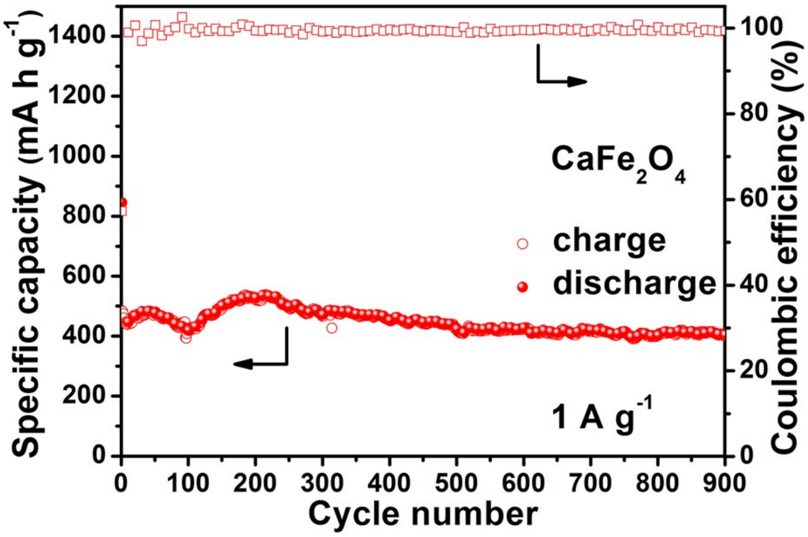

Fig. S6 Cycling performance of the $CaFe_2O_4$ calcined at 800 °C for 5 h tested at a current density of 1 A g^{-1}.

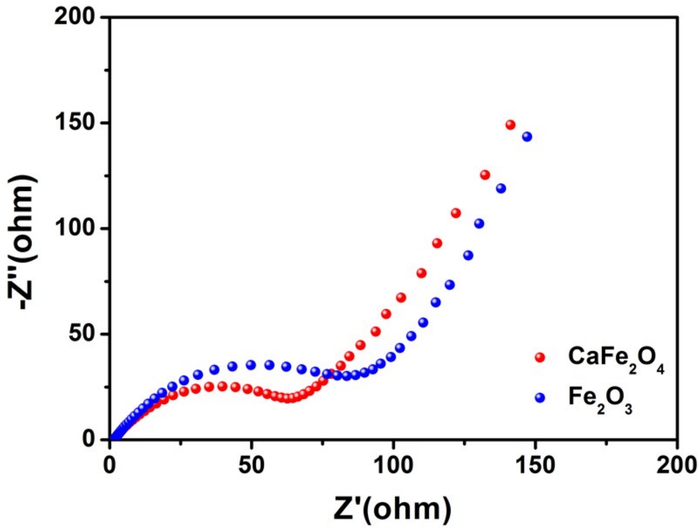

Fig. S7 Nyquist plots of $CaFe_2O_4$ and Fe_2O_3 after 5 cycles.

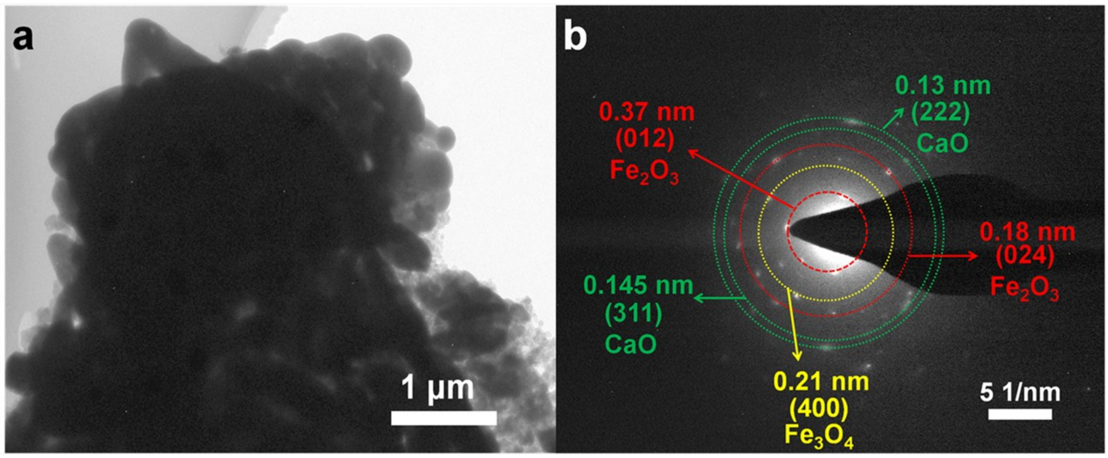

Fig. S8 (a) TEM image, (b) SAED pattern of $CaFe_2O_4$ at the delithiation state at 0.5 A g^{-1} after 5 cycles.

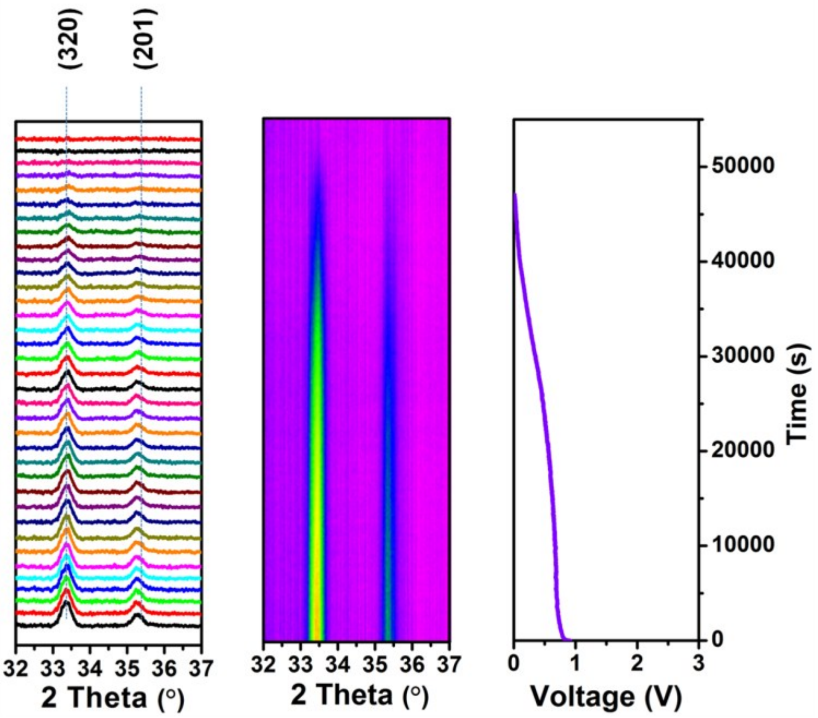

Fig. S9 *In situ* XRD results of $CaFe_2O_4$ during the initial discharge process.

Tab. S1 Comparison of properties between the $CaFe_2O_4$ (this work), graphite, Fe_2O_3 and Silicon.

	Graphite	**$CaFe_2O_4$**	**Fe_2O_3**	**Silicon**
Theoretical capacity (mA h g^{-1})	372	770	1007	4200
Reaction mechanism	Insertion	Conversion	Conversion	Alloying
Density(g cm^{-3})	2.25	4.8	5.26	2.34
Volume change	~10%	<96%	~96%	~400%
Price	Commercial	Low preparation cost	Low preparation cost	High preparation cost
Cycling performance without modification	excellent	excellent	Significant capacity decay	Significant capacity decay

Tab. S2 Electrochemical performance comparison of the porous $CaFe_2O_4$ (this work) with various Fe-based anodes.

Morphologies	**Voltage range (V)**	**Current density (A g^{-1})**	**Retained capacity (mA h g^{-1})**	**Reference**
Porous $CaFe_2O_4$	0.01-3	0.1	816 (100 cycles)	Our work
		0.5	532 (1000 cycles)	
		1	404 (900 cycles)	
Mesoporous Fe_2O_3	0.05-3	0.1	1176 (200 cycles)	[1]
		1	744 (500 cycles)	
3D net-like FeO_x/C	0.01-3	0.2	851 (50 cycles)	[2]
		1	714 (300 cycles)	
α-Fe_2O_3 void@frame microframes	0.05-3	0.2	700 (550 cycles)	[3]
porous a-Fe_2O_3 nanorods	0.01-3	0.2	740 (300 cycles)	[4]
		1	600 (300 cycles)	
Core–Shell Fe/Fe_2O_3 Nanowire	0.01-3	0.1	872 (100 cycles)	[5]
		0.5	767 (200 cycles)	
α-Fe_2O_3	0.01-3	0.1	617 (100 cycles)	[6]
		0.1	968 (100 cycles)	
Ultrathin Fe_2O_3 nanoflakes	0.05-3	0.1	1043 (100 cycles)	[7]
		5	578 (500 cycles)	

References

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