Supplementary Information for
Stabilising Mn₃O₄ Nanosheet on Graphene via
Forming 2D-2D Nanostructure for Improvement of
Lithium Storage

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1. To test the formation mechanism of 2D-2D Mn₃O₄-NS/GNS, the XRD image for reaction intermediate of MnOOH is shown in Fig. S1.

![Fig. S1 X-Ray diffraction patterns of MnOOH.](image)

2. The electrochemical performance of GN for comparing with the Mn₃O₄-NS/GNS composite is showed.
Fig. S2. Electrochemical characterization of graphene nanosheets (GNS) as electrode materials, (a) Galvanostatic charge and discharge curves for GNS at a current density of 50 mA g$^{-1}$ for various cycles (1st, 2nd, 5th and 10th); (b) capacity retentions of two samples for 50 cycles at 50 mA g$^{-1}$.

3. EIS patterns of mica-like Mn$_3$O$_4$ and Mn$_3$O$_4$-NS/GNS composite are showed.
(a) The Nyquist plot shows the impedance behavior of Mn$_3$O$_4$ and Mn$_3$O$_4$-NS/GNS.

(b) The equation for the real part of the impedance is

\[ Z_{\text{re}} = 3.29471 + 82.96 \omega^{-1/2} \]
Fig. S3 EIS patterns of Mn$_3$O$_4$ and Mn$_3$O$_4$-NS/GNS composite, (a) Nyquist plots for Mn$_3$O$_4$ and Mn$_3$O$_4$-NS/GNS composite at same voltage; plotting of real and imaginary resistance vs. inverse square root of the angular frequency for Mn$_3$O$_4$ (b) and Mn$_3$O$_4$-NS/GNS composite (c).

\[ Z_{re} = 6.901 + 14.34 \omega^{-1/2} \]

4. The 2D structure is constructed by the Mn$_3$O$_4$ nanosheets stabilizing on the graphene, in which there are re-produced space for buffering the volume changing.
Fig. S4 The TEM images of reproduced structure in Mn$_3$O$_4$-NS/GNS composite.

5. The structure of the Mn$_3$O$_4$-NS/GNS composite for HRTEM.

Fig. S5 HRTEM image of Mn$_3$O$_4$-NS/GNS 2D-2D structure