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Supporting Information

**Sandwich nanoarchitecture of $LiV_3O_8$/graphene multilayer nanomembranes via layer-by-layer self-assembly for long-cycle-life lithium-ion battery cathodes**

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| | $R_s$ (Ω) | $R_f$ (Ω) | $R_{ct}$ (Ω) |
|---|---|---|---|
| M-nLVO electrode | 9 | 66 | 32 |
| M-nLVO/GNs electrode | 5 | 25 | 18 |

**Table S1**. Impedance parameters calculated from equivalent circuit

**Figure S1.** Structure of poly(diallydimethylammonium chloride) (PDDA).

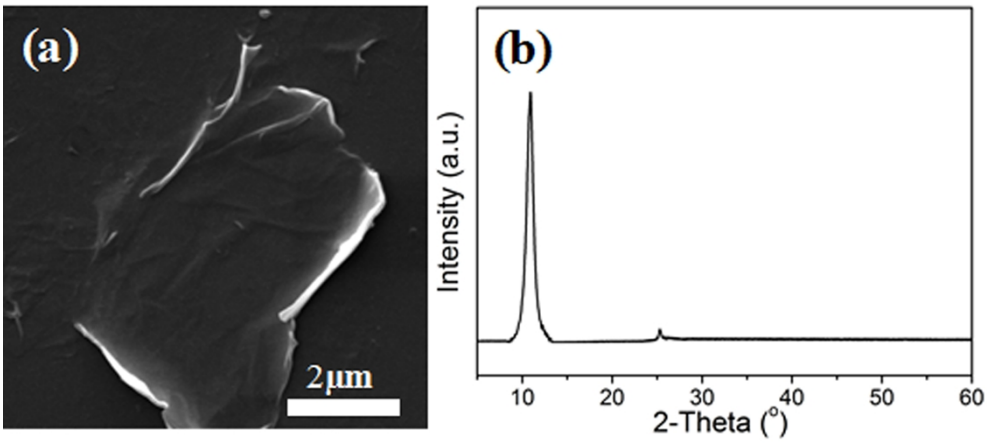


**Figure S2.** (a) SEM image of as-prepared graphene oxide nanosheets. (b) XRD pattern of the image of as-prepared graphene oxide nanosheets.

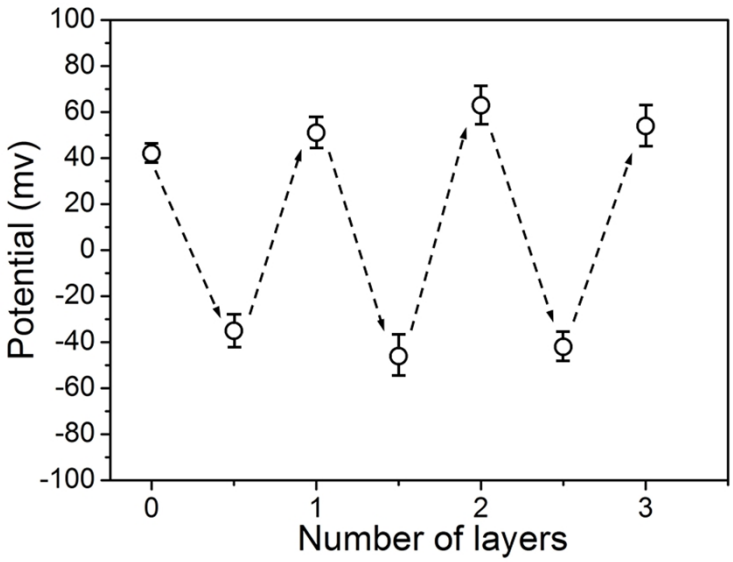


**Figure S3.** Zeta-potentials of a PDDA-modified Ni foam alternatively coated with GO/ PDDA-modified nLVO as a function of layer number.

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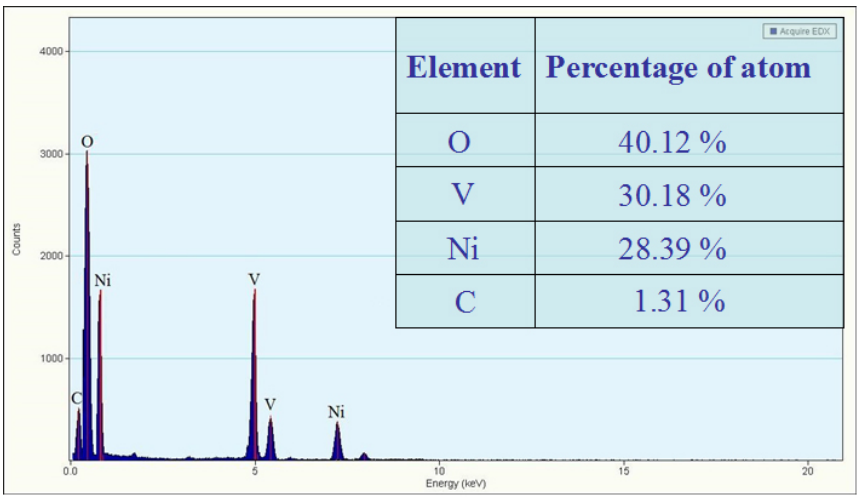


| Element | Percentage of atom |
|---|---|
| O | 40.12 % |
| V | 30.18 % |
| Ni | 28.39 % |
| C | 1.31 % |

**Figure S4.** The EDS pattern of the M-nLVO/GNs hybrid electrode.

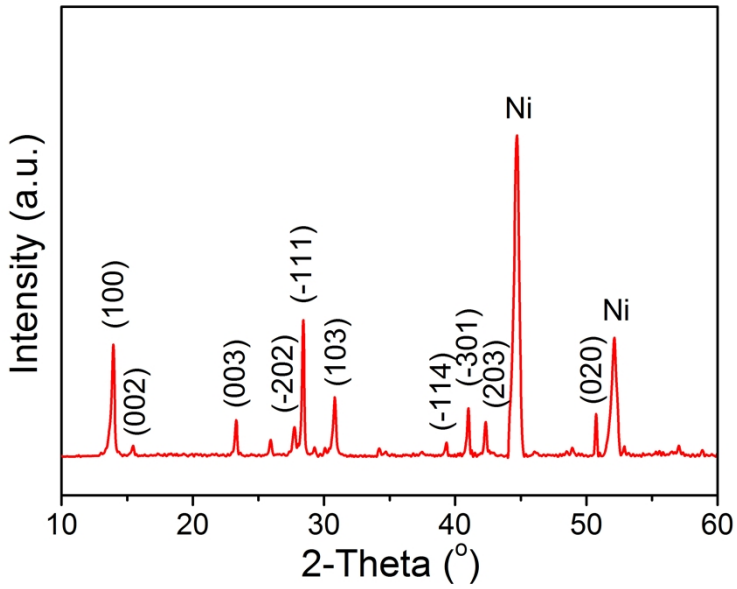


**Figure S5.** XRD patterns of M-nLVO/GNs hybrid electrode.

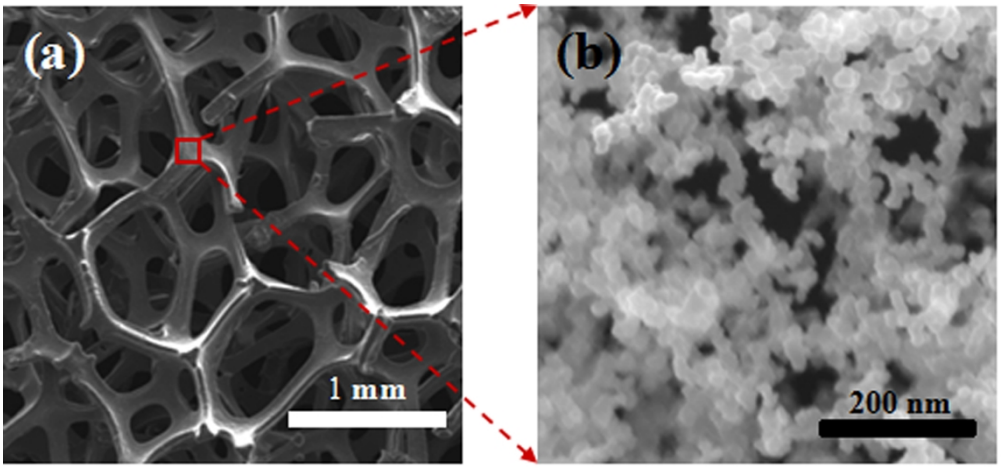


**Figure S6.** SEM (a) overview of the LVO nanostructure-coating 3D porous Ni foam electrode; and (b) Magnified SEM image of LVO nanoparticle in (a).

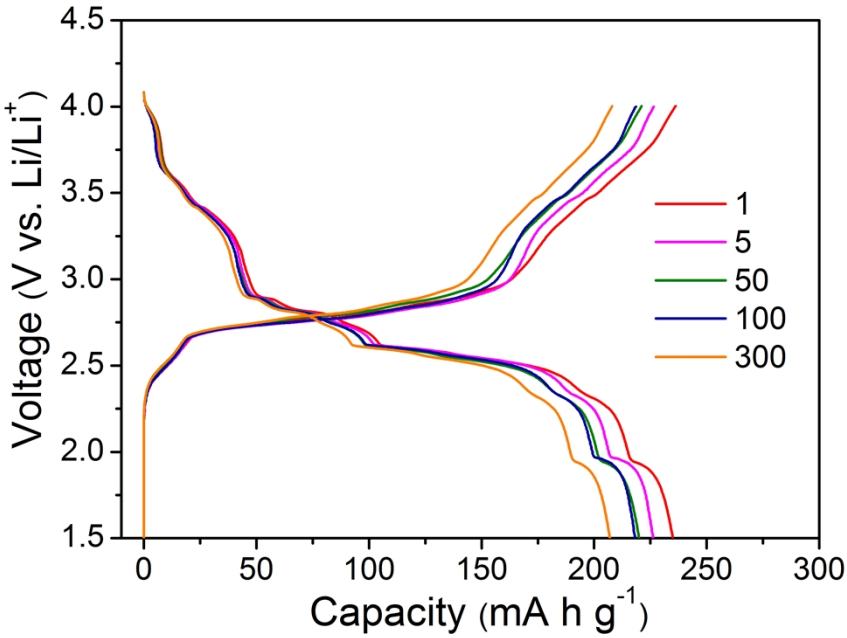


**Figure S7.** Discharge/charge curves at different cycles of the M-nLVO/GNs hybrid electrode at current densities of 0.3 A $g^{-1}$ (1 C).

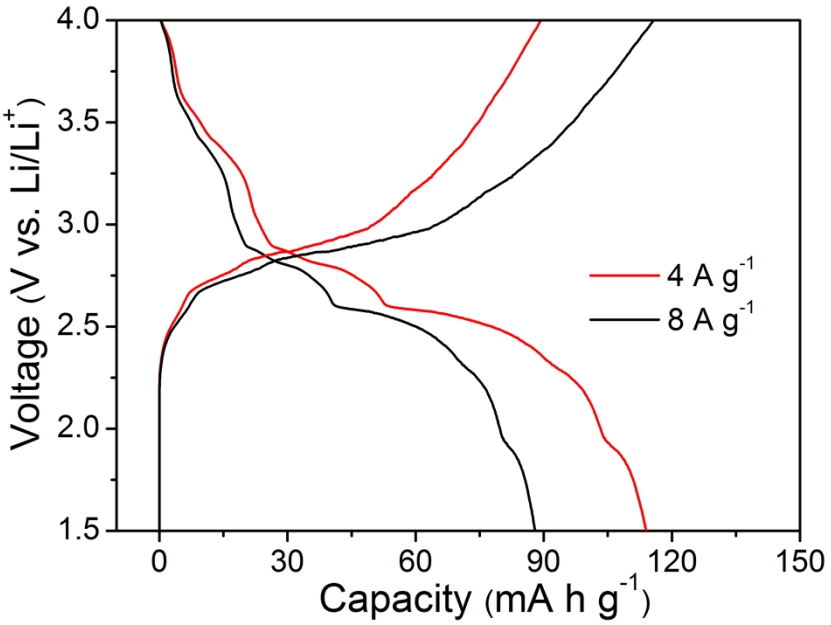


**Figure S8.** First-cycle discharge curves of the M-nLVO/GNs hybrid electrode at current densities of 0.4 and 0.8 A $g^{-1}$.

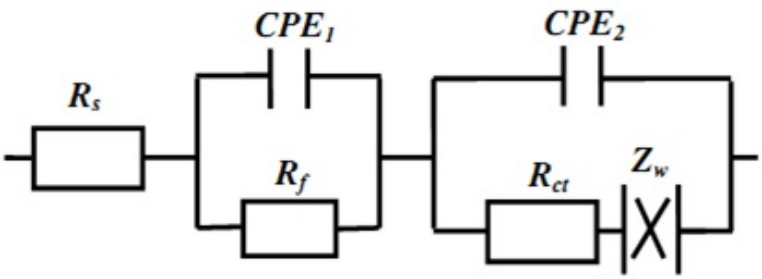


**Figure S9.** Electrical schematics of the equivalent circuit used for fitting of EIS curves.