Electronic Supplementary Material (ESI) for Nanoscale

Supplementary Information

Layer-by-layer assembled MoO_2/graphene thin film as a high-capacity and binder-free anode for lithium-ion batteries

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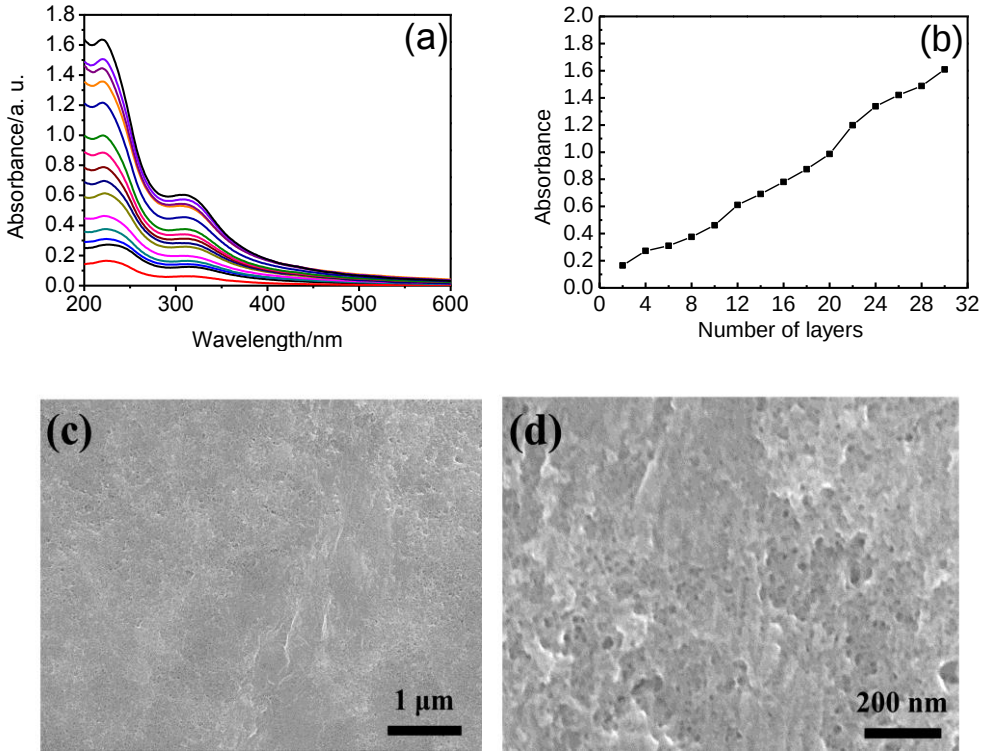

Fig. S1 (a) UV-visible absorption spectra of the multilayer $(PDDA/GO/PDDA/PMA)_n$ film on the quartz glass slide (n= 2, 4, 6,…,30). (b) The peak intensity at 220 nm vs. the layer number. (c, d) SEM images for the $(PDDA/GO/PDDA/PMA)_n$ precursor.

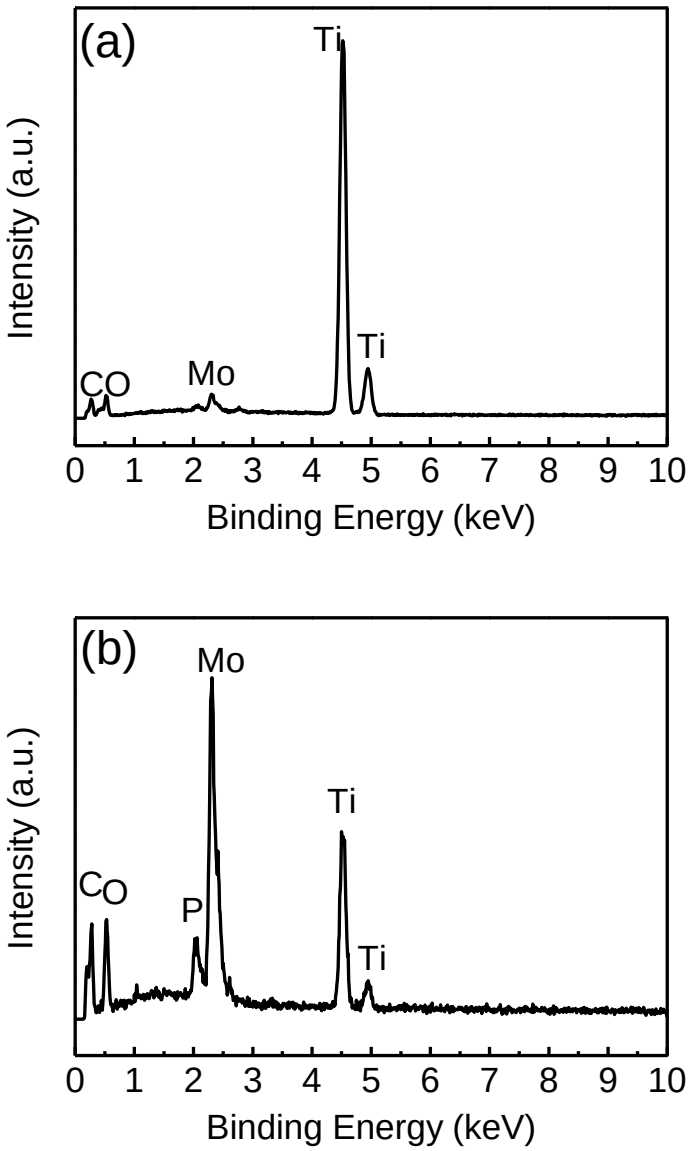

Fig. S2 Typical EDX spectra for (a) the MoO_2/graphene composite obtained at 500 ºC in a 5 % H_2/Ar atmosphere for 5 h and (b) the $(PDDA/GO/PDDA/PMA)_n$ precursor on the Ti foil obtained by the LBL process.

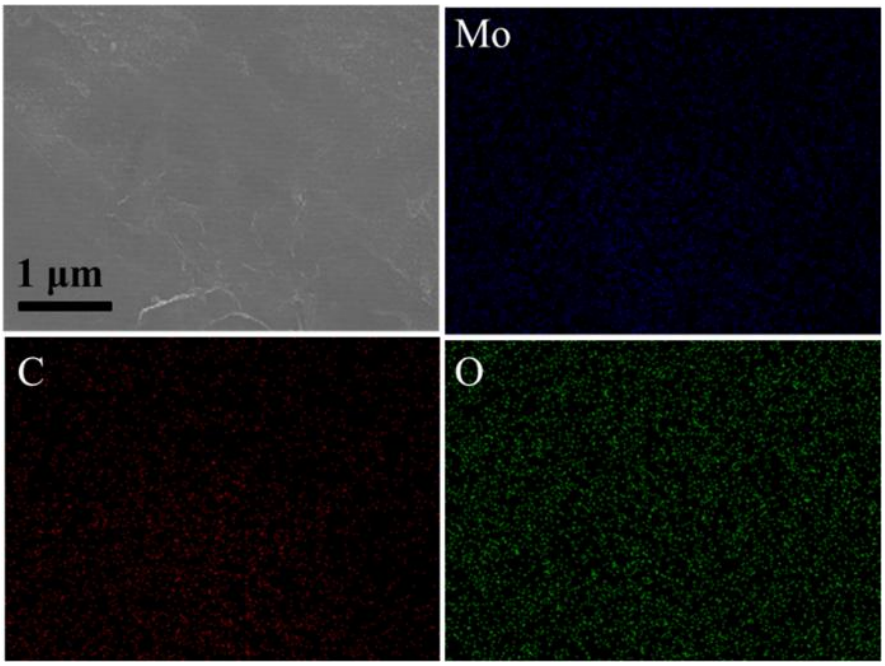

Fig. S3 SEM image obtained in the EDX-mapping mode and corresponding elemental mapping of Mo, C, and O in the MoO_2/graphene hybrid film.

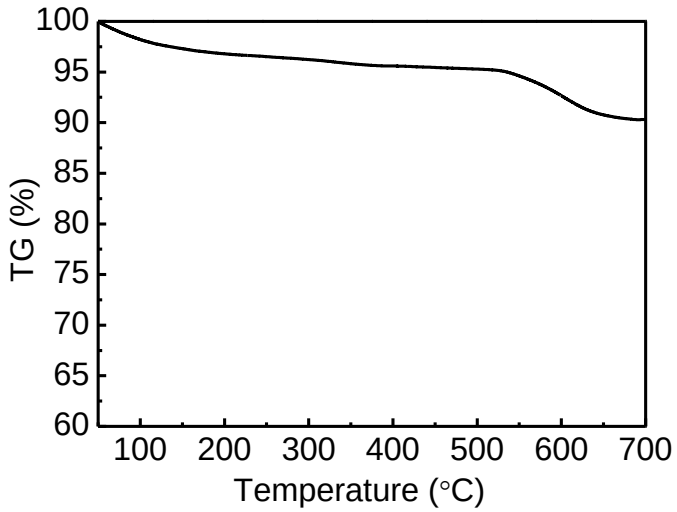

Fig. S4 TG curve for the as-formed MoO_2/graphene hybrid measured at a heating rate of 10 ºC min^{-1} in a flowing air. The weight decrease between 200–690 ºC can be attributed to the comprehensive effects of the oxidation of MoO_2 and the combustion of graphene. The graphene content in the MoO_2/graphene product is evaluated to be about 19.3 wt %.

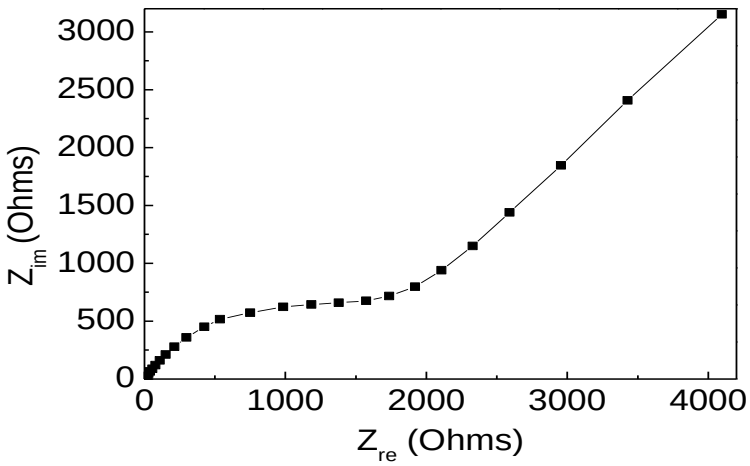

Fig. S5 Electrochemical impedance spectrum of the hybrid MoO_2/graphene electrode after 1 discharge-charge cycle over the frequency range from 100 kHz to 0.1 Hz.

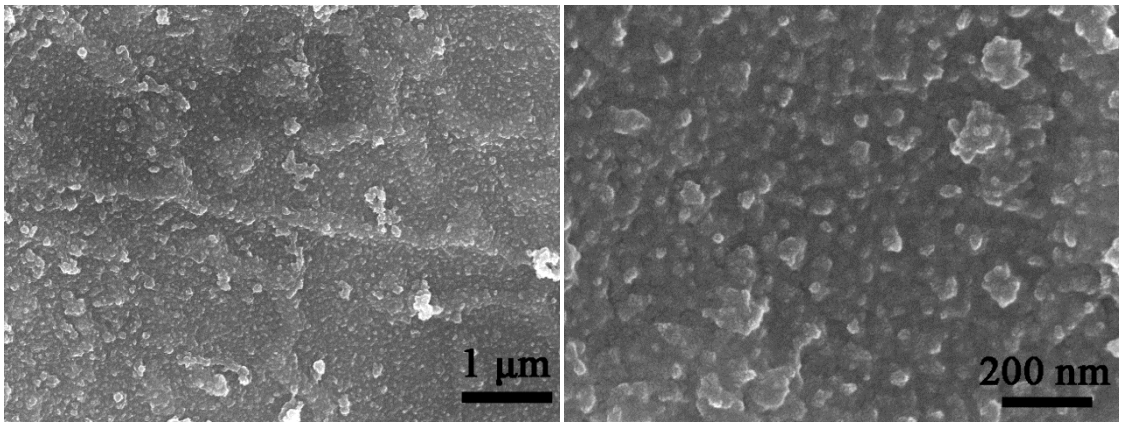

Fig. S6 The FE-SEM images of the film electrode after 100 discharge-charge cycling at a current density of 478 mA g^{-1} in the voltage range of 0.01–3 V.

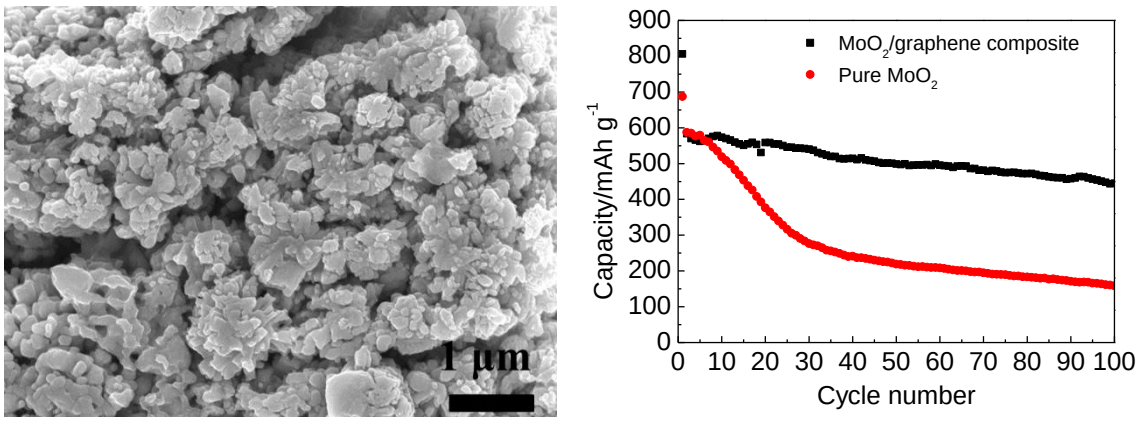

Fig. S7 Left: FE-SEM image of MoO_2 product prepared by annealing PMA at 500 ºC at a heating rate of 1 ºC min^{-1} in 5% H_2/Ar for 5 h; Right: the cycling performances of the as-made MoO_2/graphene electrode and pure MoO_2 electrode at a current density of 478 mA g^{-1} in the voltage range of 0.01–3 V.

Pure MoO_2 was synthesized by annealing PMA at 500 ºC at a heating rate of 1 ºC min^{-1} in 5% H_2/Ar for 5 h. The working electrode of pure MoO_2 was prepared by mixing 80 wt % MoO_2 particles, 10 wt % acetylene black (Super-P), and 10 wt % polycinylidene fluoride (PVDF).