Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Standing Carbon-Coated Molybdenum Dioxide Nanosheets on Graphene: Morphology Evolution and Lithium Ion Storage Properties

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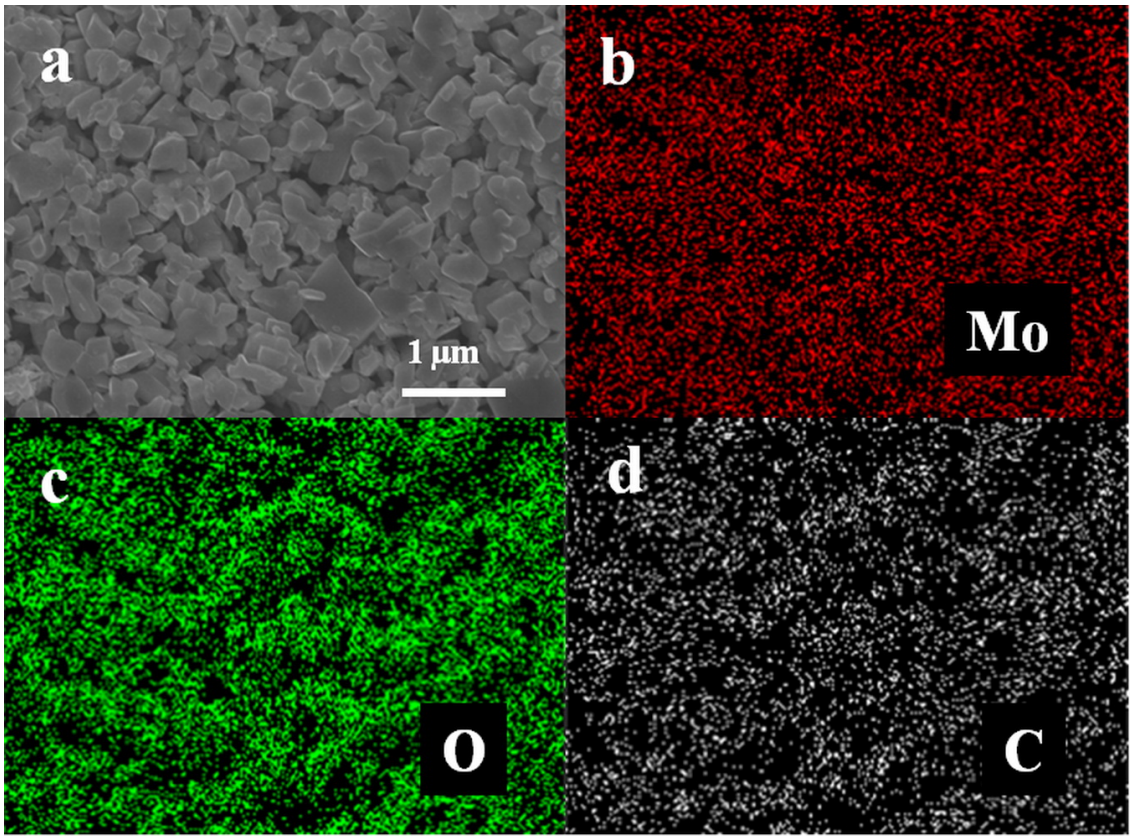

Figure S1. Elemental mapping images of the MoO_2@C composite. Mo, O, and C elements are distributed uniformly in the product. It is confirmed that carbon is formed around MoO_2 by acetylene decomposition.

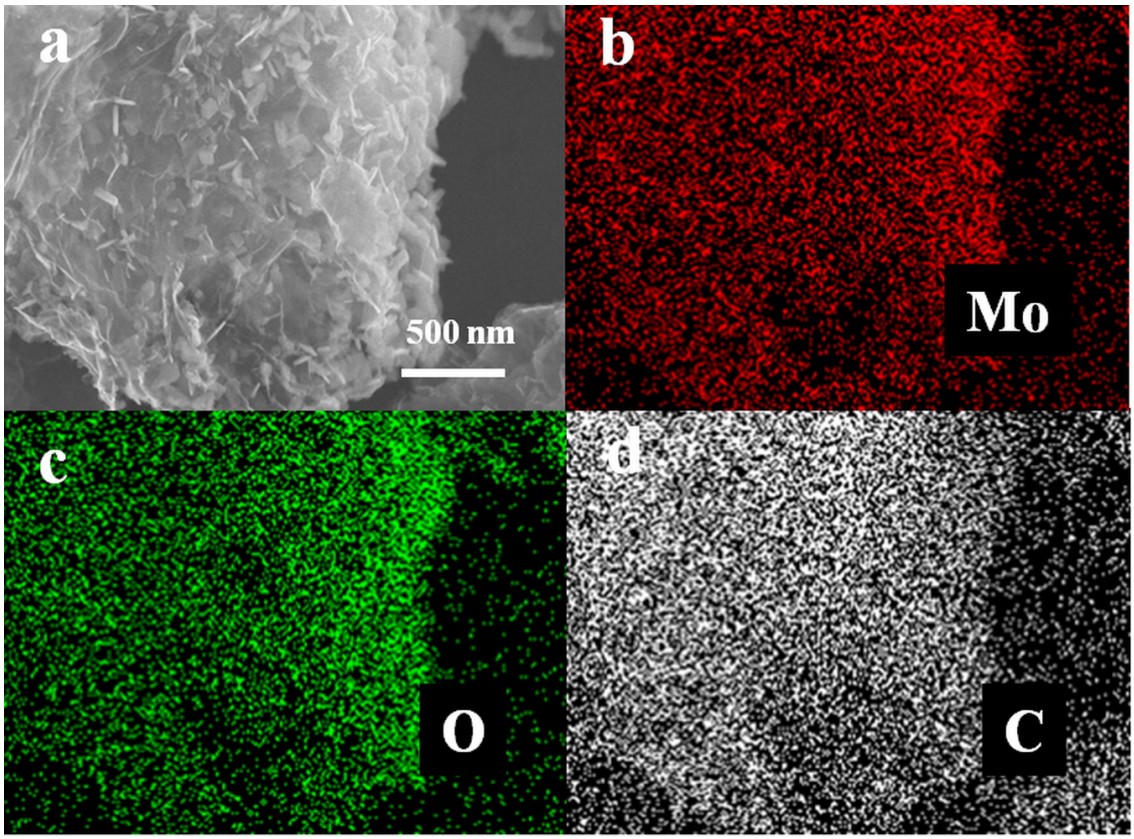

Figure S2. Elemental mapping images of the standing MoO_2@C nanosheets on graphene (48.3 % MoO_2). Mo, O, and C elements are also distributed uniformly in the composite.

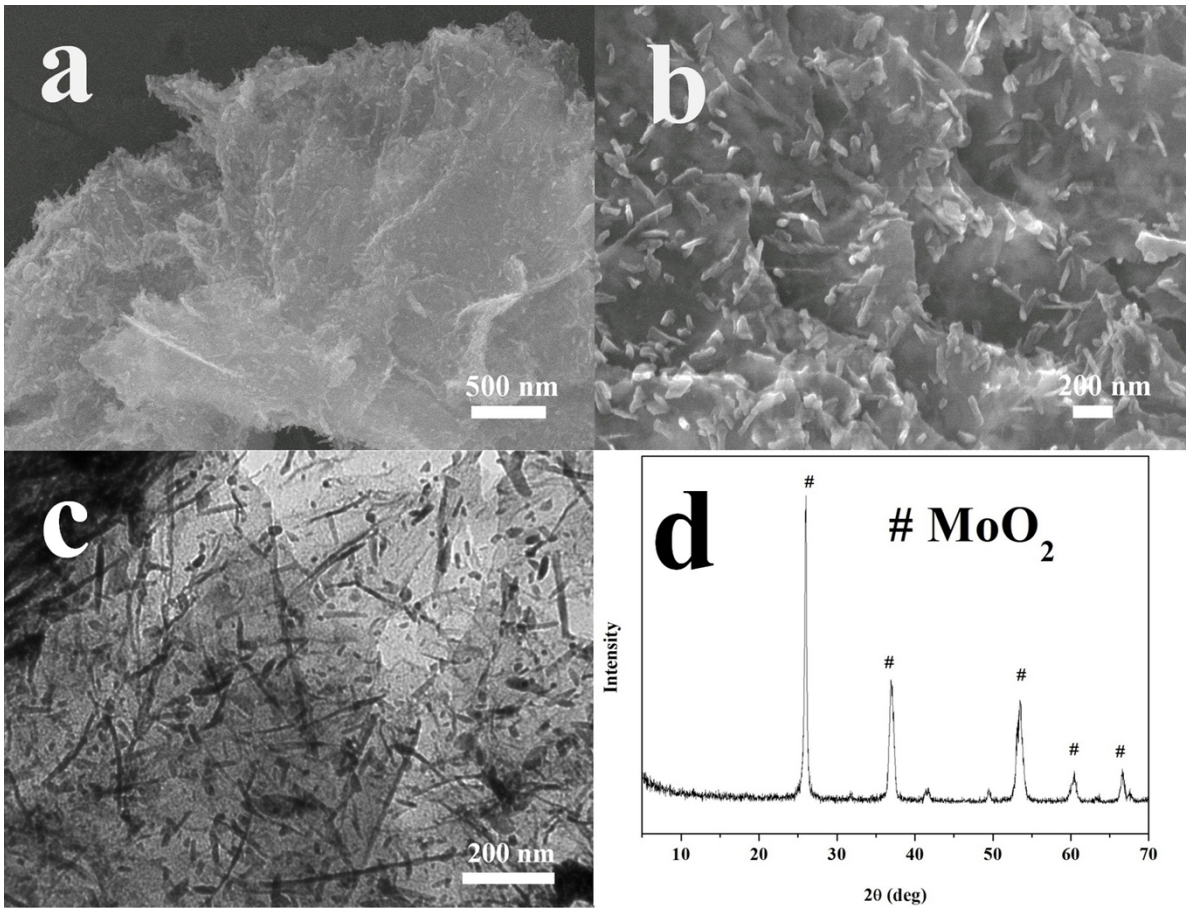

Figure S3. Graphene supported carbon-coated MoO_2 nanorods and nanoparticles: (a-b) SEM images, (c) TEM image, and (d) XRD patterns. A number of small MoO_2 nanorods with lengths of ~100-200 nm and diameters of ~10-20 nm are observed along with many small MoO_2 nanoparticles (~5-10 nm) in the composite.

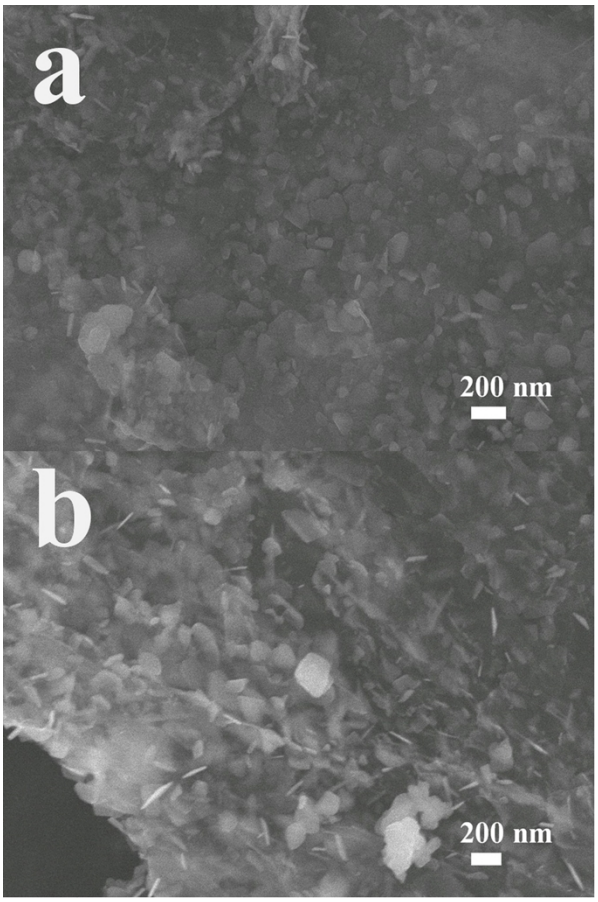

Figure S4. SEM images of the standing MoO_2@C nanosheets on graphene. (a) reaction time: 0.5 h, (b) reaction time: 1 h. It seems that MoO_2@C nanosheets are not formed completely compared to the main product after 2 h as shown in Figure 3 of main text. These tattered nanosheets exhibit smaller size of ~100-150 nm after shorter reaction time.

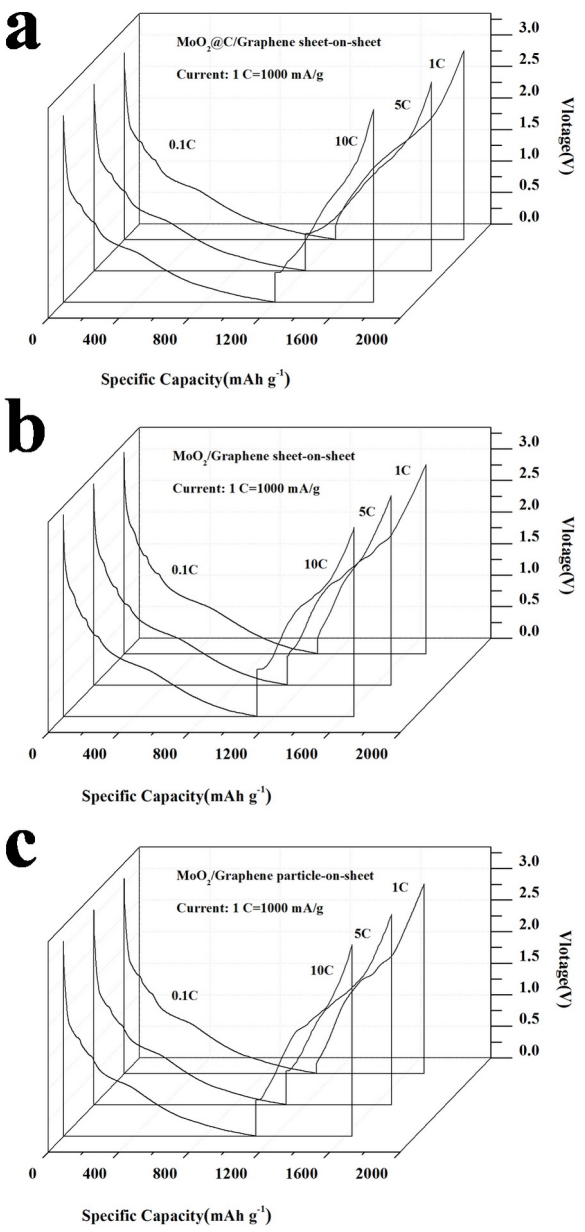

Figure S5. First-cycle discharge (lithium insertion) and charge (lithium extraction) curves of (a) the standing MoO_2@C nanosheets on graphene, (b) the MoO_2/Graphene sheet-on-sheet composite, (c) the MoO_2/Graphene particle-on-sheet composite at various large current densities of 1, 5, and 10 C (1 C = 1000 mA g^{-1}).

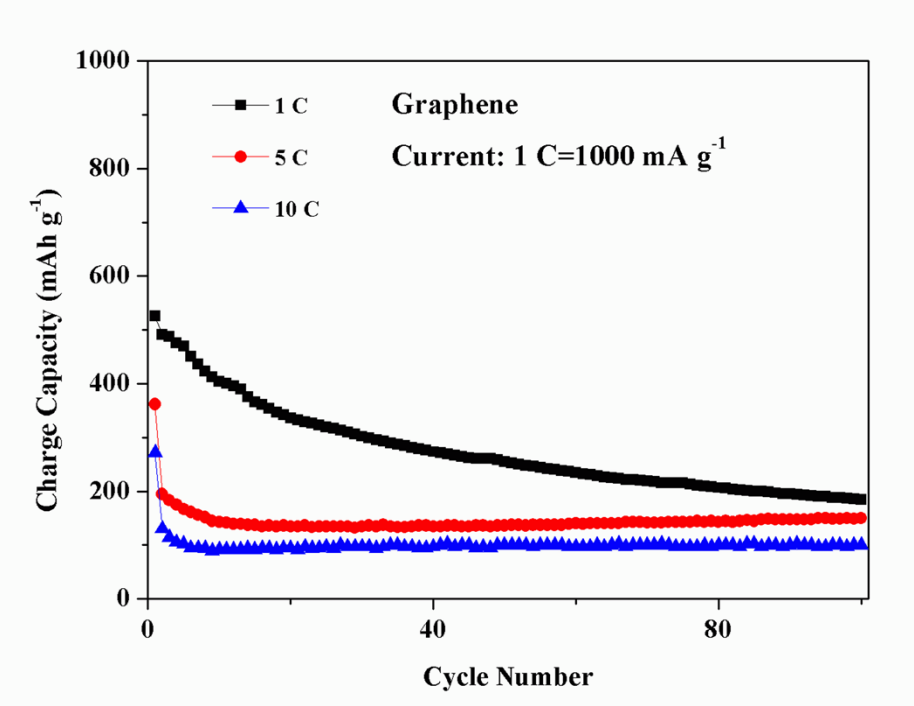

Figure S6. High-rate cycling performances of bare graphene. Initial charge (lithium extraction) capacities of bare graphene were 526, 362, and 272 mAh/g at 1 C, 2 C, and 5 C respectively, which decreased to 231, 150, 101 mAh/g after 100 cycles.

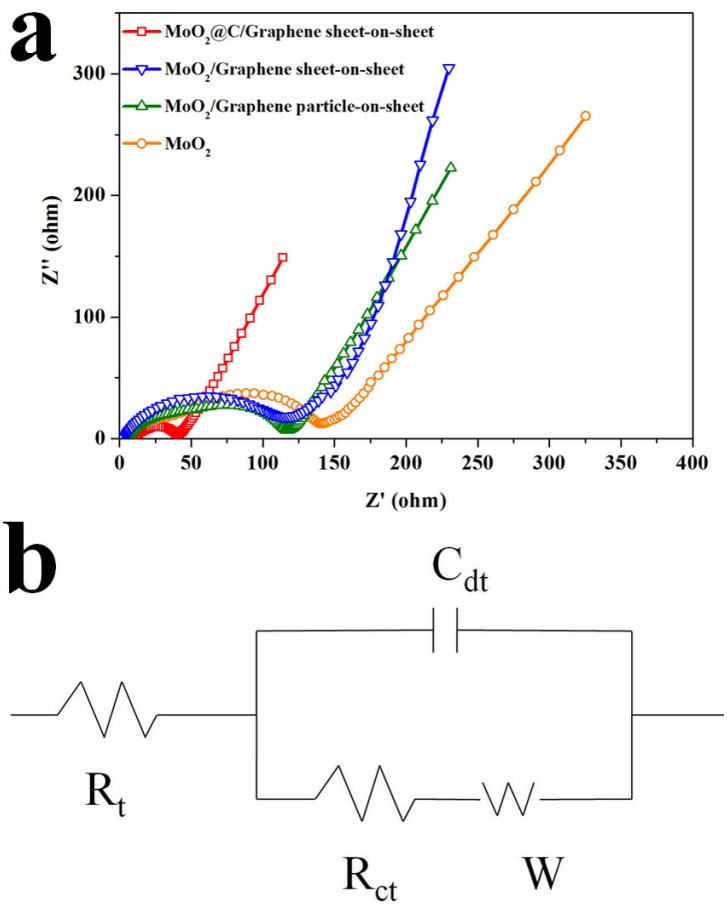

Figure S7. (a) Nyquist plots of the standing MoO_2@C nanosheets on graphene, MoO_2/Graphene sheet-on-sheet, MoO_2/Graphene particle-on-sheet and MoO_2@C composites, (b) Equivalent circuits.

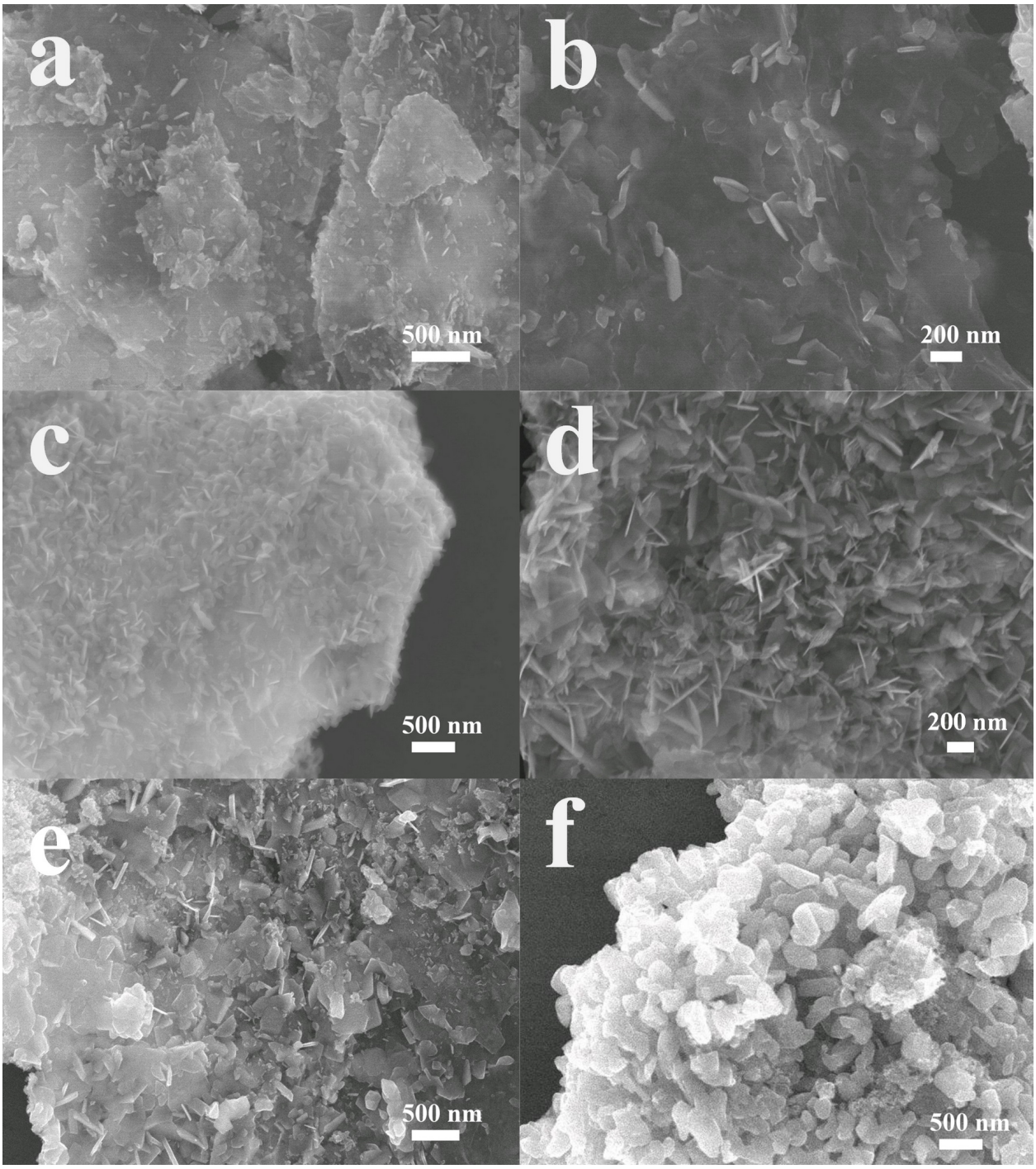

Figure S8. SEM images of the MoO_2@C/Graphene sheet-on-sheet composites with various amounts of MoO_2: (a-b) 34.7 % MoO_2, (c-d) 71.9 % MoO_2, (e) 85.7 % MoO_2 and (f) 95.2 % MoO_2.

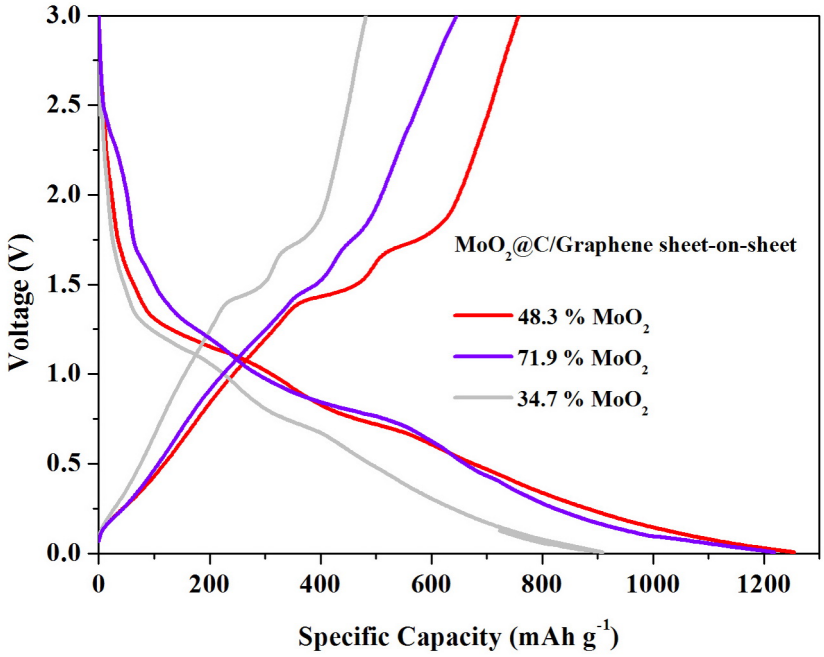

Figure S9. The first cycle discharge (lithium insertion) and charge (lithium extraction) curves of the MoO_2@C/Graphene sheet-on-sheet composites with 34.7 %, 48.3 % and 71.9 % MoO_2.

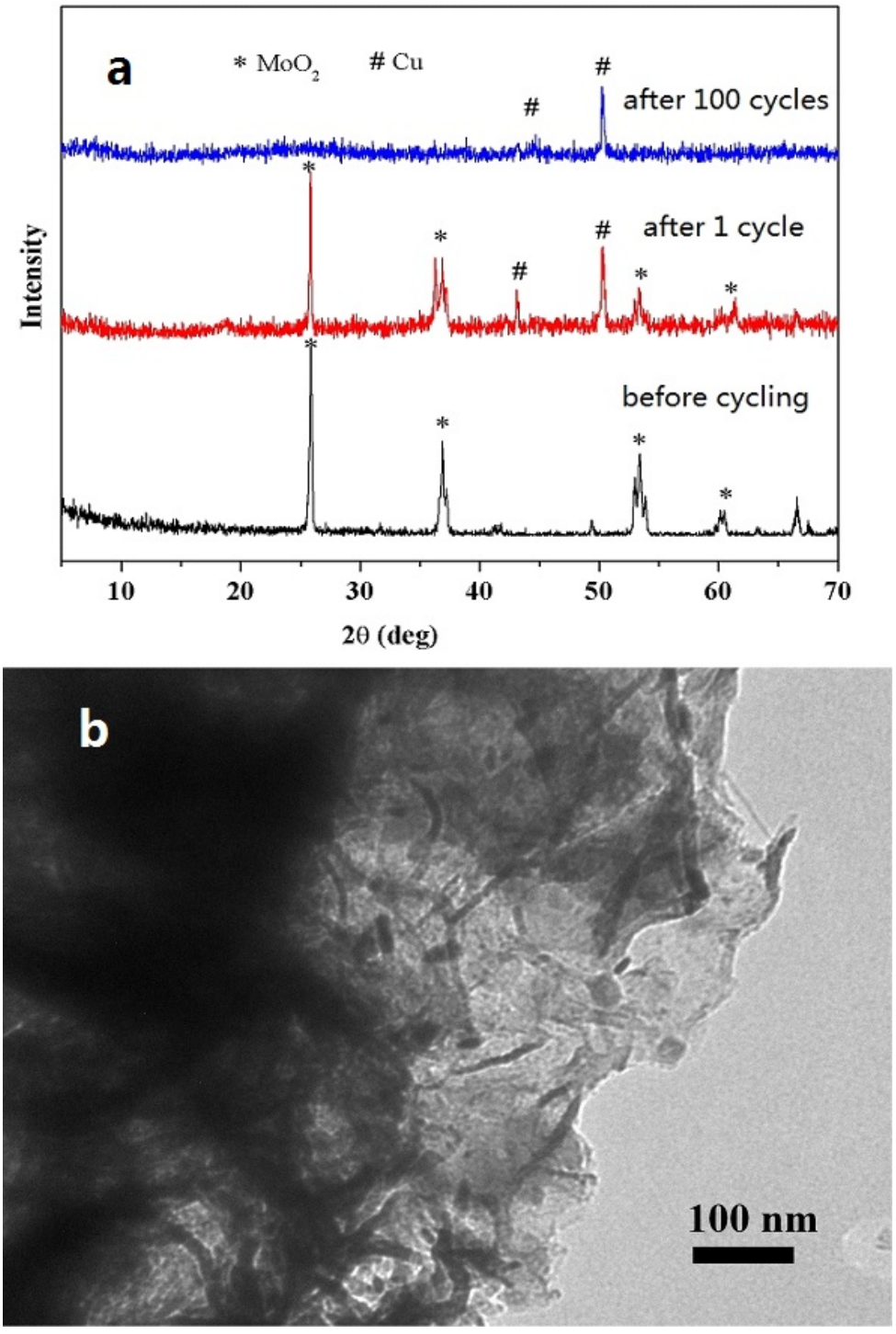

Figure S10. (a) XRD patterns of the cycled MoO_2@C/Graphene (48.3 % MoO_2). The crystalline MoO_2 is changed to be amorphous after repetitive 100 cycles. (b) TEM image of the cycled composite electrode after 100 cycles. The cross-section of the standing MoO_2 nanosheets can be still observed on graphene although there is a presence of a large amount of PVDF binder and carbon black in the electrode.