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Supramolecule-mediated synthesis of MoS₂/rGO composites with enhanced electrochemical performance for reversible lithium storages

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Figure S1. N₂ adsorption-desorption isotherms of the (a) pristine MoS₂ and (b) MoS₂/rGO-2 composite.

The N₂ adsorption-desorption isotherms of the pristine MoS₂ and MoS₂/rGO-2 composite were measured at 77 K by using a Brunauer–Emmett–Teller instrument (BET; TriStar II 3020) as shown Figure S1. The BET surface areas of pristine MoS₂
and MoS\textsubscript{2}/rGO-2 composite are 14.3 and 35.2 m\textsuperscript{2} g\textsuperscript{-1}, respectively. The surface area of MoS\textsubscript{2}/rGO-2 composite is closed to that of the mesoporous Co\textsubscript{3}O\textsubscript{4} sheets/3D graphene networks (34.5 m\textsuperscript{2} g\textsuperscript{-1})\textsuperscript{1} and MoS\textsubscript{2} nanosheets/carbon nanotube paper (32 m\textsuperscript{2} g\textsuperscript{-1})\textsuperscript{2}.

**Figure S2.** Pore-size distribution curves of (a) pristine MoS\textsubscript{2} and (b) MoS\textsubscript{2}/rGO-2 composite.

The pore size distributions of the pristine MoS\textsubscript{2} and MoS\textsubscript{2}/rGO-2 composite calculated from BJH method are given in Figure S2, which reveals that both the pristine MoS\textsubscript{2} and MoS\textsubscript{2}/rGO-2 composite are characteristic of the mesopores. The mesopores of the pristine MoS\textsubscript{2} may originate from the void spaces among the interlaced flakes. It is worth notice that when the pore size ranges from 9 nm to 30 nm, MoS\textsubscript{2}/rGO-2 composite exhibits much higher dV/dD value than the pristine MoS\textsubscript{2}. Therefore, the mesopores of MoS\textsubscript{2}/rGO-2 composite should be contributed to not only the void spaces between MoS\textsubscript{2}-rGO heterostructural sheets, but also its numerous pores and apertures. Even if these pores and apertures may not produce significant contribution to the surface area, they can provide more shortened paths of lithium ion diffusion and more active sites for lithium ion accommodation, and also facilitate the easy access of the electrolyte, resulting in the great improvement in the electrochemical performances of the MoS\textsubscript{2}/rGO composite for reversible lithium storage.

For the sake of the comparison with MoS\textsubscript{2}/rGO-2 composite, the SEM image and pore size distribution of MoS\textsubscript{2}/rGO-C composite, which was prepared with 0.02
mol/L CTAB (cetyltrimethylammonium bromide) in hydrothermal solution\(^3\) are also presented. As shown in Figure S3, MoS\(_2\)/rGO-C composite shows a wrinkled thin flaky appearance, from which the pore or aperture can be hardly found. Figure S4 shows the N\(_2\) adsorption-desorption isotherm and pore size distribution of MoS\(_2\)/rGO-C composite. The BET surface area of MoS\(_2\)/rGO-C composite is 31.6 27.8 m\(^2\) g\(^{-1}\). Figure S4(b) shows that the MoS\(_2\)/rGO-C composite exhibits lower dV/dD value than MoS\(_2\)/rGO-2 composite, when the pore size ranges from 9 to 30 nm. The fact is ascribed to that there are a lot of pores and apertures in the MoS\(_2\)/rGO-2 composite prepared by supramolecule-mediated hydrothermal route.

Figure S3. SEM image of MoS\(_2\)/rGO-C composite prepared by CTAB-assisted hydrothermal route, in which the concentration of CTAB was 0.002 mol L\(^{-1}\) in hydrothermal solution\(^3\).

Figure S4. (a) N\(_2\) adsorption-desorption isotherms of the MoS\(_2\)/rGO-C composite; (b) Pore-size distribution curves of MoS\(_2\)/rGO-C composite and MoS\(_2\)/rGO-2 composite.
References:

