Electronic Supplementary Information (ESI)

Supramolecule-mediated synthesis of MoS_2/rGO composites with enhanced electrochemical performance for reversible lithium storages

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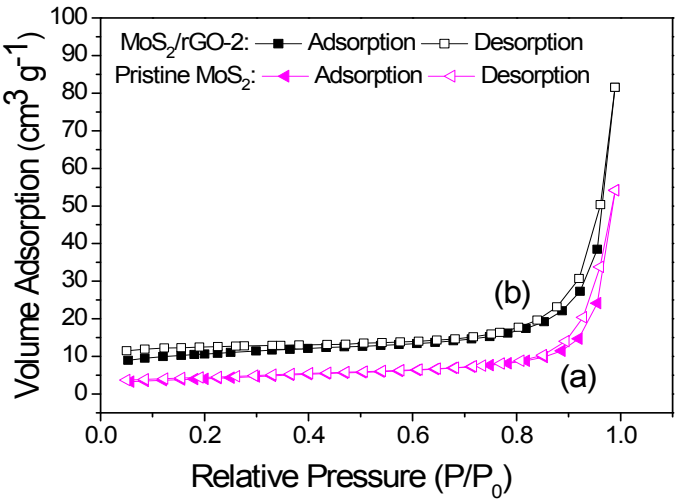

Figure S1. N_2 adsorption-desorption isotherms of the (a) pristine MoS_2 and (b) MoS_2/rGO-2 composite.

The N_2 adsorption-desorption isotherms of the pristine MoS_2 and MoS_2/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 MoS_2

and MoS_2/rGO-2 composite are 14.3 and 35.2 m^2 g^{-1}, respectively. The surface area of MoS_2/rGO-2 composite is closed to that of the mesoporous Co_3O_4 sheets/3D graphene networks (34.5 m^2 g^{-1})[1] and MoS_2 nanosheets/carbon nanotube paper (32 m^2 g^{-1}).[2]

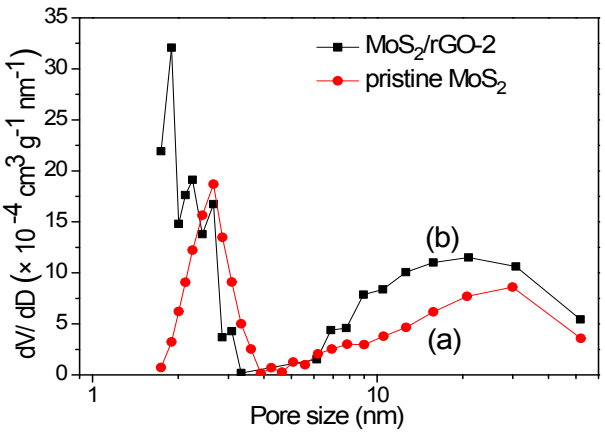

Figure S2. Pore-size distribution curves of (a) pristine MoS_2 and (b) MoS_2/rGO-2 composite.

The pore size distributions of the pristine MoS_2 and MoS_2/rGO-2 composite calculated from BJH method are given in Figure S2, which reveals that both the pristine MoS_2 and MoS_2/rGO-2 composite are characteristic of the mesopores. The mesopores of the pristine MoS_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_2/rGO-2 composite exhibits much higher dV/dD value than the pristine MoS_2. Therefore, the mesopores of MoS_2/rGO-2 composite should be contributed to not only the void spaces between MoS_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_2/rGO composite for reversible lithium storage.

For the sake of the comparison with MoS_2/rGO-2 composite, the SEM image and pore size distribution of MoS_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.

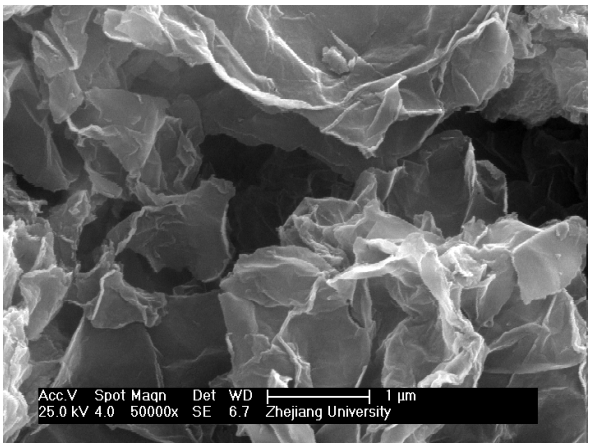

Figure S3. SEM image of MoS_2/rGO-C composite prepared by CTAB-assisted hydrothermal route, in which the concentration of CTAB was 0.002 mol L^{-1} in hydrothermal solution.[3]

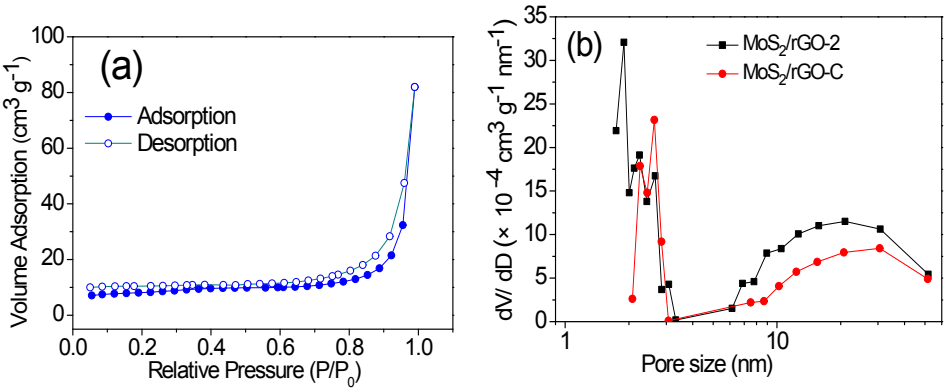

Figure S4. (a) N_2 adsorption-desorption isotherms of the MoS_2/rGO-C composite; (b) Pore-size distribution curves of MoS_2/rGO-C composite and MoS_2/rGO-2 composite.

References:

1. Liu, Y.; Cheng, Z.; Sun, H.; Arandiyan, H.; Li, J.; Ahmad, M., Mesoporous Co3O4 sheets/3D graphene networks nanohybrids for high-performance sodium-ion battery anode. *J. Power Sources,* 2015, *273*, 878-884.

2. Li, H.; Wang, X.; Ding, B.; Pang, G.; Nie, P.; Shen, L.; Zhang, X., Enhanced Lithium-Storage Performance from Three-Dimensional MoS2 Nanosheets/Carbon Nanotube Paper. *Chemelectrochem,* 2014, *1* (7), 1118-1125.

3. Huang, G. C.; Chen, T.; Chen, W. X.; Wang, Z.; Chang, K.; Ma, L.; Huang, F. H.; Chen, D. Y.; Lee, J. Y., Graphene-Like MoS2/Graphene Composites: Cationic Surfactant-Assisted Hydrothermal Synthesis and Electrochemical Reversible Storage of Lithium. *Small,* 2013, *9* (21), 3693-3703.