Electronic Supporting Information

Phase-transfer-assisted confinement growth of mesoporous MoS_2@graphene van der Waals supraparticles for unprecedented ultrahigh-rate sodium storage

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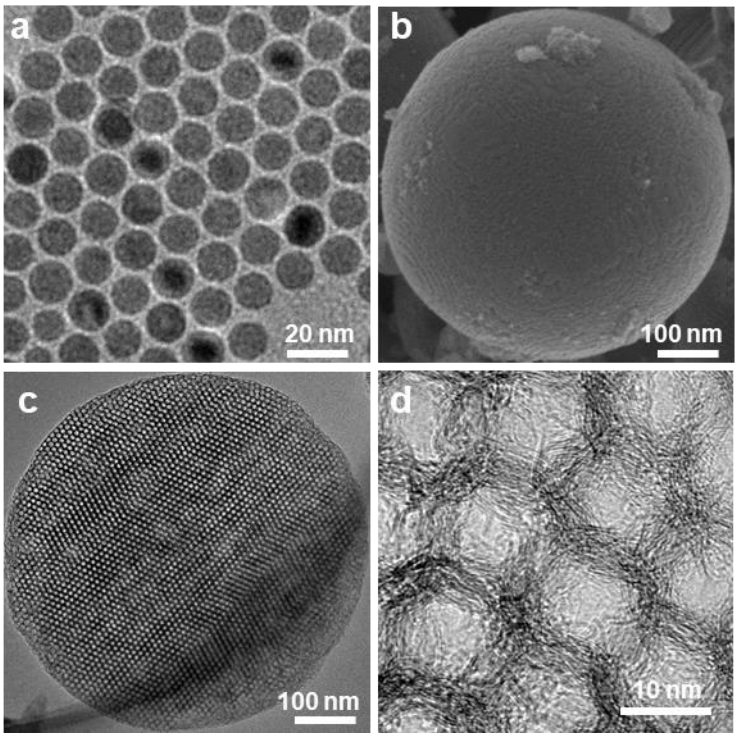

Fig. S1 (a) TEM image of Fe_3O_4 nanocrystals used for assembling superlattices. (b) SEM image of Fe_3O_4 nanocrystal supraparticles obtained by an emulsion-based assembly process. (c) TEM and (d) HRTEM images of mesoporous graphene supraparticles derived from Fe_3O_4 nanocrystal superlattices.

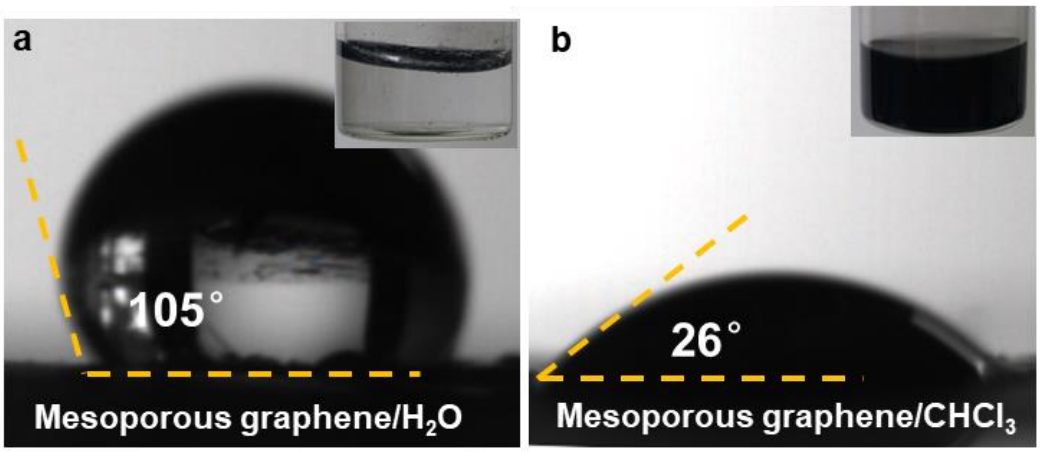

Fig. S2 Contact angle measurements of mesoporous graphene supraparticles with the solvent of (a) H_2O and (b) $CHCl_3$, confirming their hydrophobicity. Insets show the photographs of mesoporous graphene supraparticles dispersed in H_2O and $CHCl_3$, respectively.

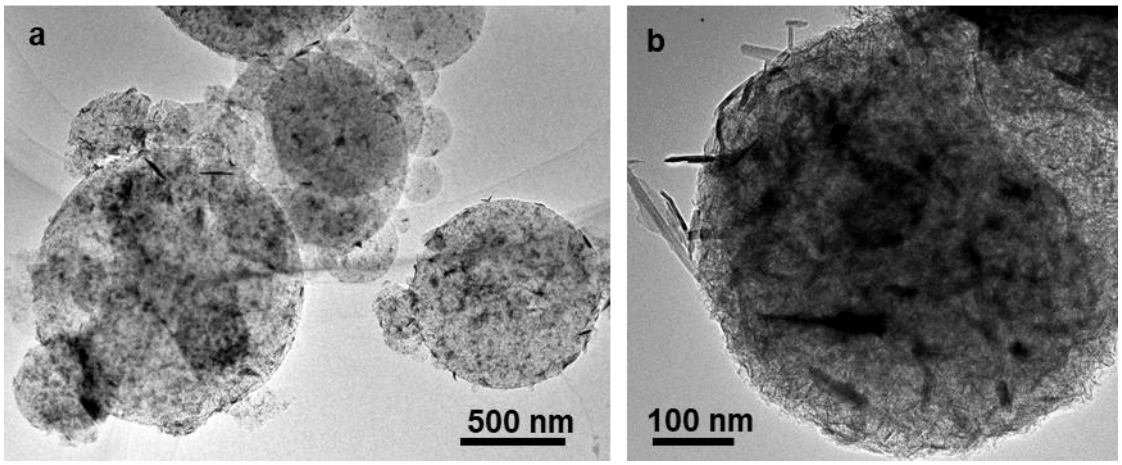

Fig. S3 (a, b) TEM images of the product resulting the impregnation of $(NH_4)_2MoS_4$ assisted by tuning the solvent polarity followed by calcination, showing the limited confinement growth of MoS_2 nanosheets within the graphitic framework.

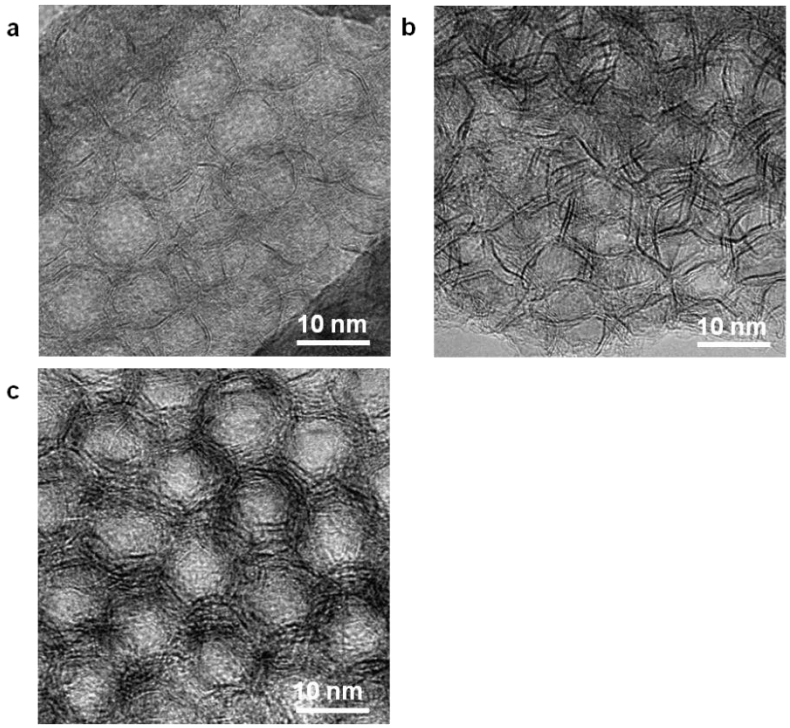

Fig.S4 (a-c) TEM images of MoS_2@graphene with the MoS_2 layer number ranging from 1L to 3L.

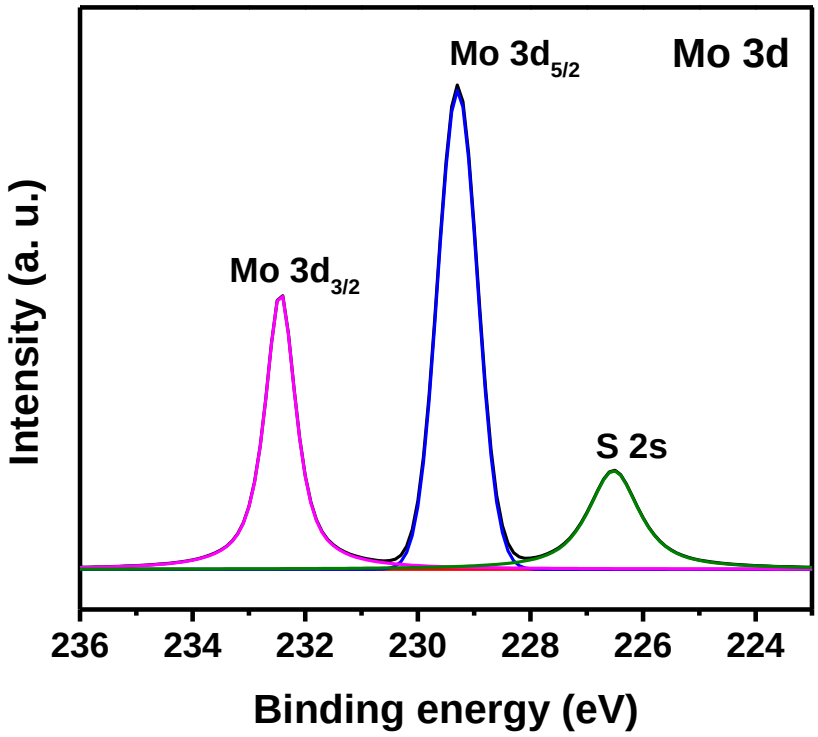

Fig.S5 Mo 3d XPS spectrum of MoS_2@graphene supraparticles.

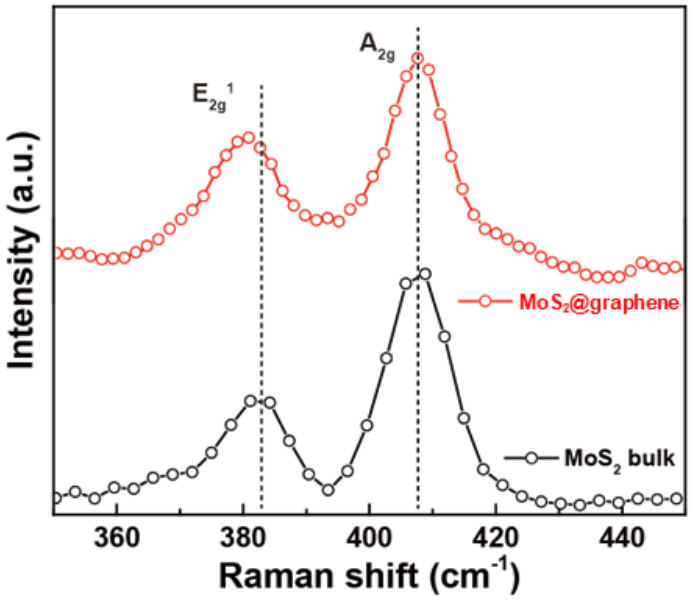

Fig.S6 Raman spectra of MoS_2@graphene supraparticles and bulk MoS_2.

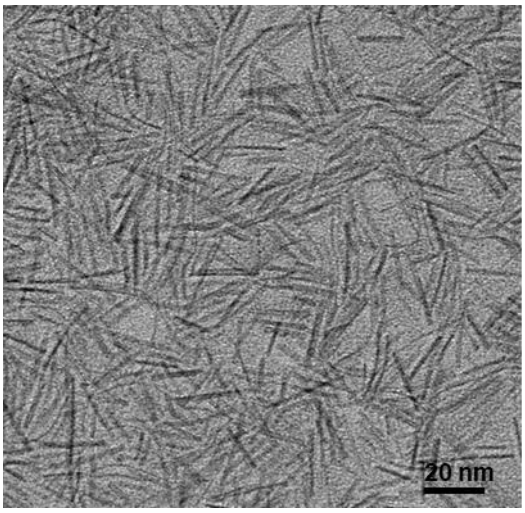

Fig. S7 Typical TEM image of colloidal MoS_2 nanoflakes.

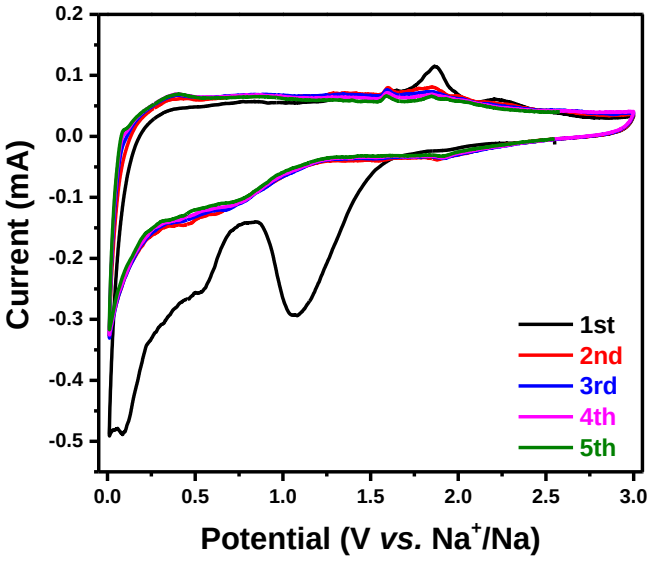

Fig. S8 CV curves of MoS_2@graphene supraparticles.

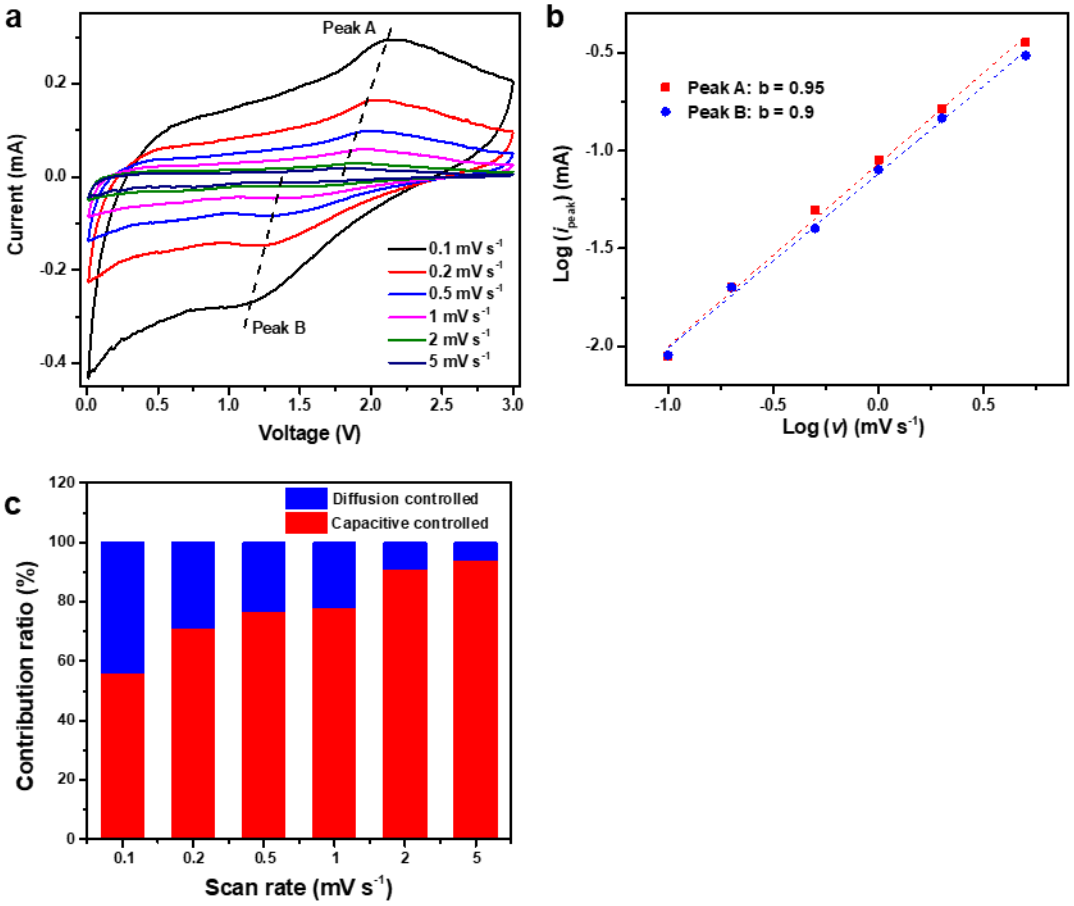

Fig.S9 (a) CV curves of MoS_2@graphene supraparticles at scan rates (v) ranging from 0.1 to 5 mV s^{-1}. (b) Plots of log(i) versus log(v) for the cathodic and anodic peaks shown in (a). (c) Normalized contribution ratios of capacitive and diffusion capacities at different scan rates.

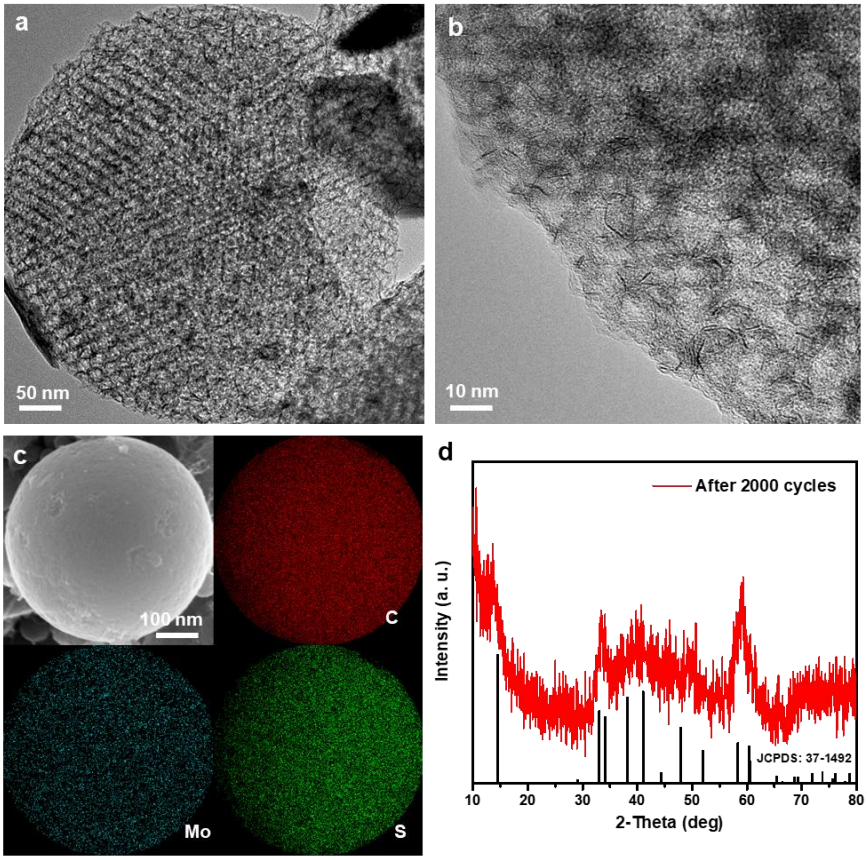

Fig.S10 Structural characterization of MoS_2@graphene supraparticles after 2000 cycles. (a) TEM image, (b) HRTEM image, (c) STEM image and corresponding elemental mapping, and (d) XRD pattern.

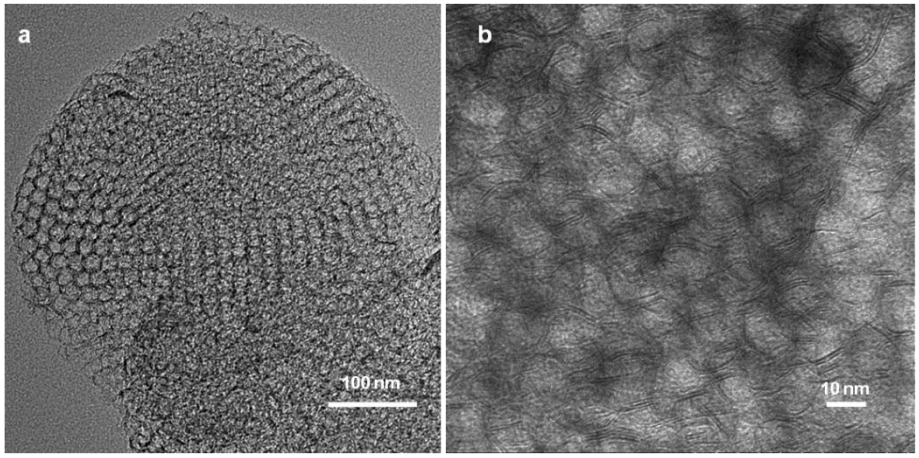

Fig. S11 (a, b) Typical TEM images of WS_2@graphene supraparticles.

Table S1. SIB performance comparison between MoS_2@graphene supraparticles and representative state-of-the-art 2H-MoS_2 anode materials reported previously.

Anodes	**Voltage range (V)**	**Current density (A g^{-1})/cycle number/capacity retention (mAh g^{-1})**	**Ref.**
MoS_2@graphene supraparticles	0.01-3	10/2000/309	This work
3D MoS_2-graphene spheres	0.01-3	1.5/600/322	[1]
MoS_2 manosheets	0.01-3	0.04/100/386	[2]
MoS_2@graphene nanoribbons	0.01-3	5/1500/158	[3]
MoS_2 nanosheets@MOFs	0.01-3	1/1000/265	[4]
MoS_2/graphene nanosheets	0.01-3	0.3/250/421	[5]
Porous MoS_2/carbon spheres	0.01-3	2/1000/416	[6]
MoS_2@carbon nanofiber interpenetrated graphene	0.01-3	1/1000/412	[7]
Crystalline MoS_2 nanosheets	0.01-3	2/800/337	[8]
C@MoS_2@PPy composites	0.01-3	5/294/500	[9]
MoS_2 nanosheets confined in N-doped mesoporous carbon	0.01-3	1/300/200	[10]
MoS_2/graphene hybrids	0.01-3	0.1/150/415	[11]
Exfoliated MoS_2 nanosheets	0.01-3	0.1/100/385	[12]

References

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