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Supplementary information

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for

High-yield production of mono- or few- layer transition metal dichalcogenides nanosheets by electrochemical lithium ion intercalation-based exfoliation method

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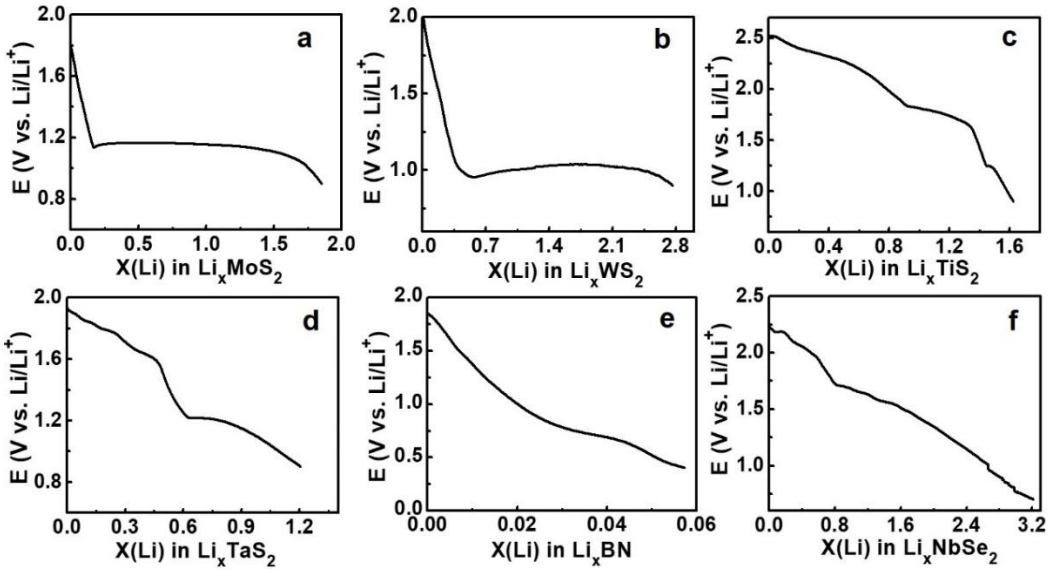
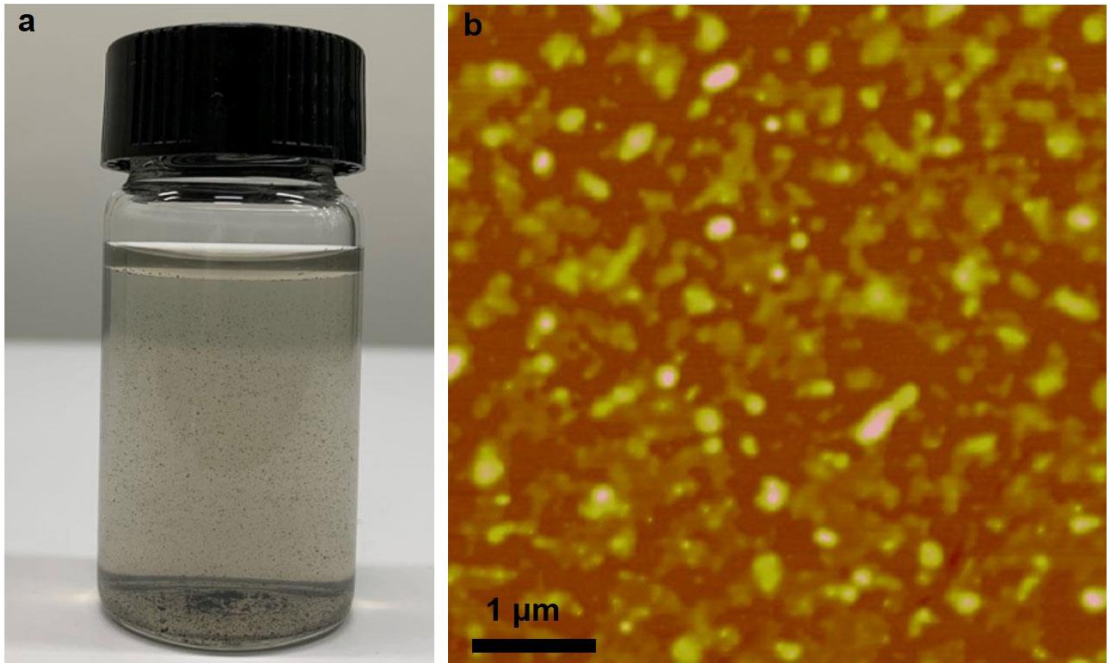
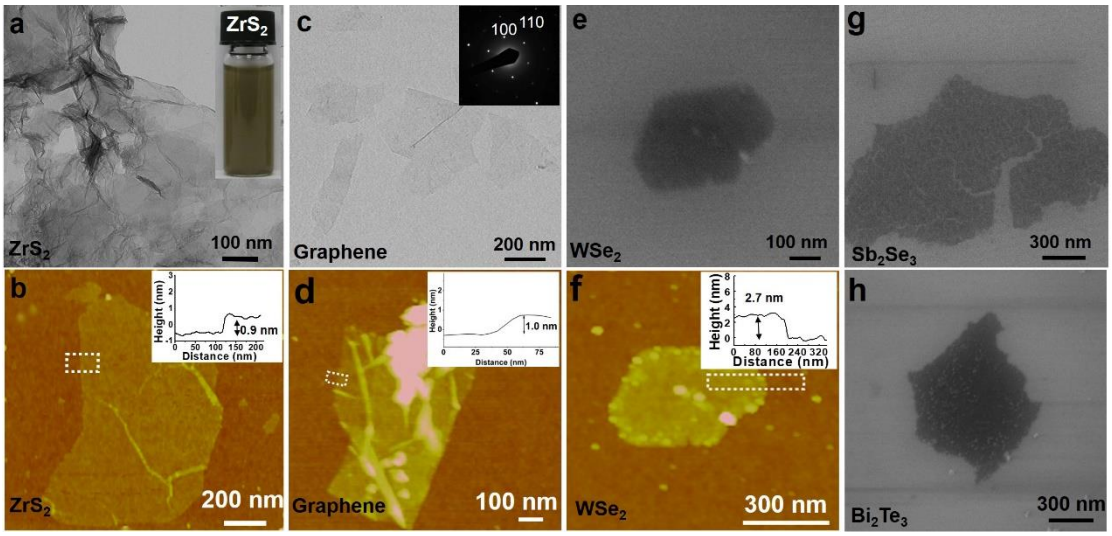


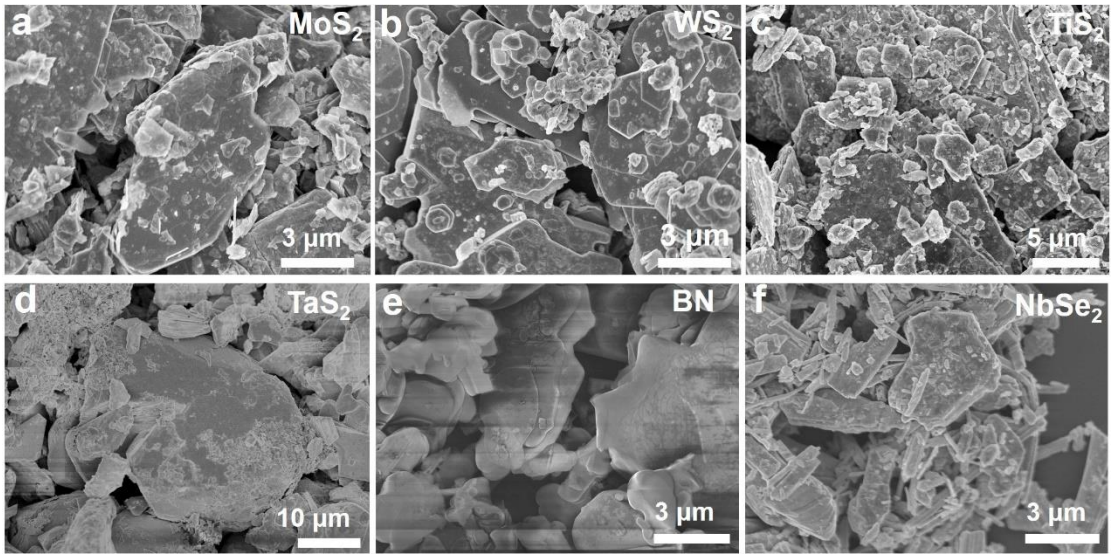
Supplementary Figure 1 Galvanostatic discharge curve for (a) MoS_2, (b) WS_2, (c) TiS_2, (d) TaS_2, (e) BN, (f) $NbSe_2$. Adapted with permission from ref. [1-3].



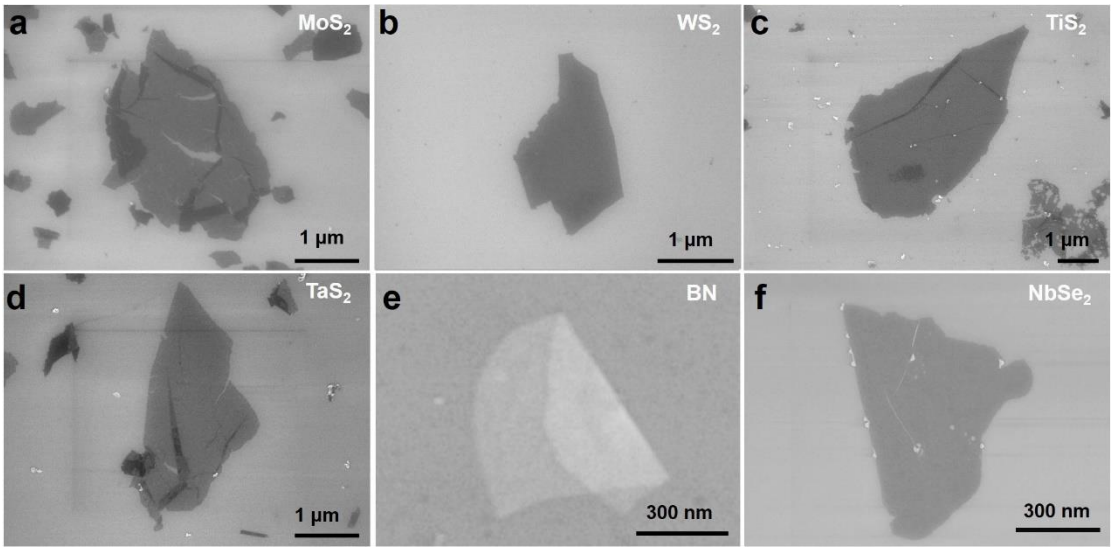
Supplementary Figure 2 (a) Photographs of the exfoliated MoS_2 nanosheets, which were not fully exfoliated, and some of the bulk particles can be clearly seen. (b) Unsatisfactory AFM image of the exfoliated MoS_2 nanosheets, in which lots of particles are observed.



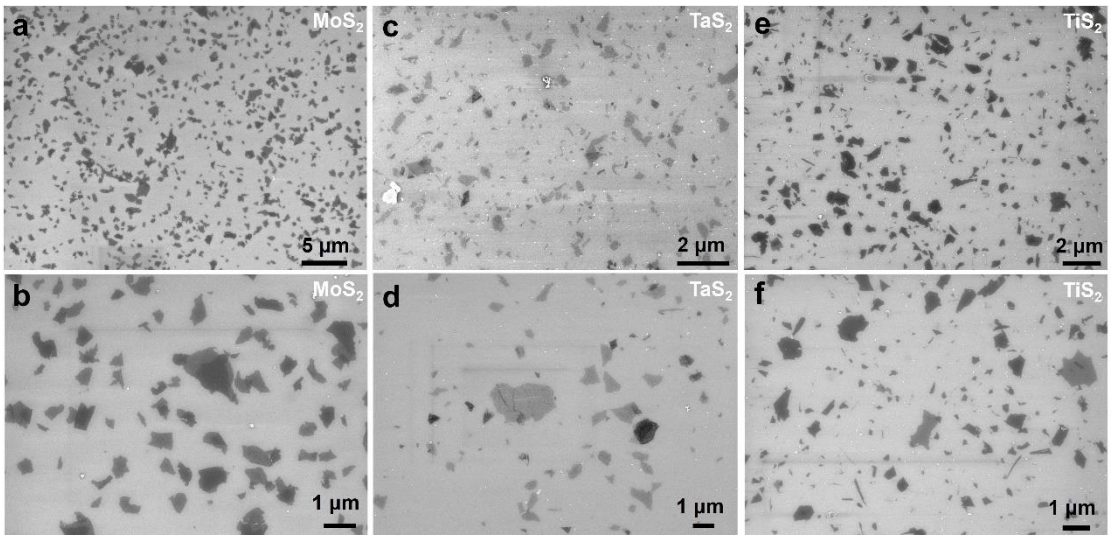
Supplementary Figure 3 (a) TEM image of the exfoliated ZrS_2 nanosheets. (b) AFM image of the exfoliated ZrS_2 nanosheets, showing the average thickness of ~0.9 nm. (c) TEM image of the exfoliated graphene nanosheets. (d) AFM image of the exfoliated graphene nanosheets, showing the average thickness of ~1.0 nm. (e) SEM image of the exfoliated WSe_2 nanosheets. (f) AFM image of the exfoliated WSe_2 nanosheets, showing the average thickness of ~2.7 nm. (g) SEM image of the exfoliated Sb_2Se_3 nanosheets. (h) SEM image of the exfoliated Bi_2Se_3 nanosheets. Adapted with permission from ref. [1,2].



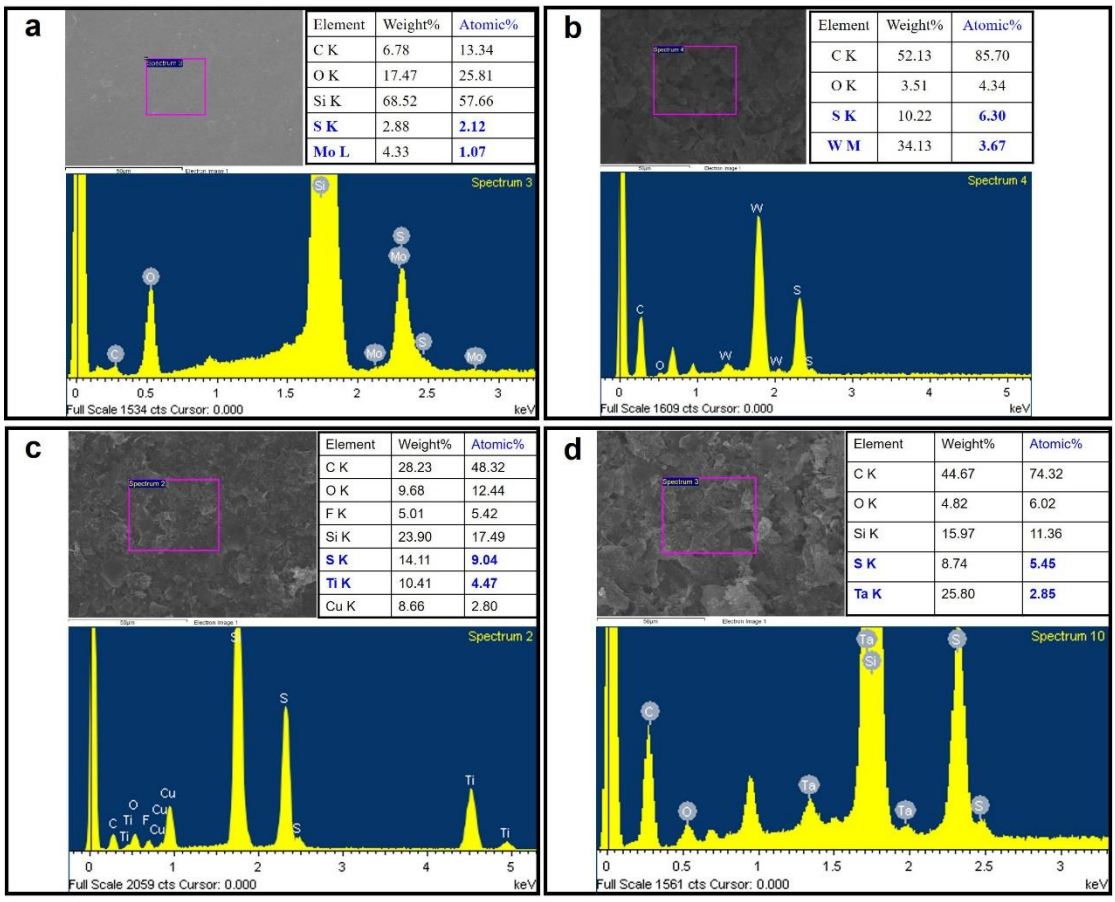
Supplementary Figure 4 SEM images of (a) bulk MoS_2, (b) bulk WS_2, (c) bulk TiS_2, (d) bulk TaS_2, (e) bulk BN, (f) bulk $NbSe_2$.



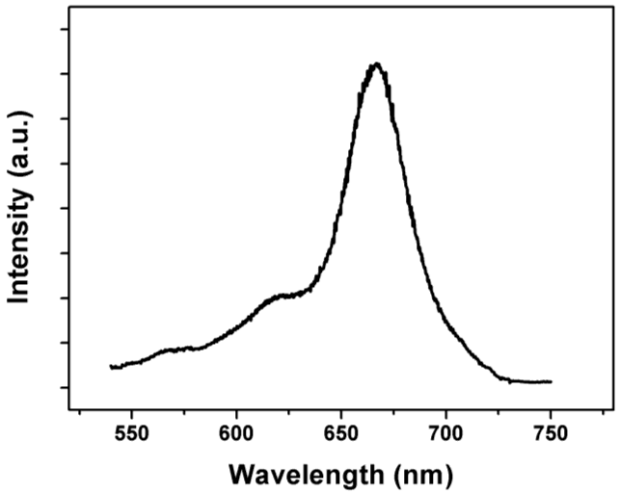
Supplementary Figure 5 SEM images of the exfoliated (a) MoS_2, (b) WS_2, (c) TiS_2, (d) TaS_2, (e) BN, (f) $NbSe_2$ nanosheets. Note that TMDs nanosheets shows the darker contrast in comparison with SiO_2 substrate since the conductivity of TMDs nanosheet are better than SiO_2 substrate, while BN shows white or lighter contrast.



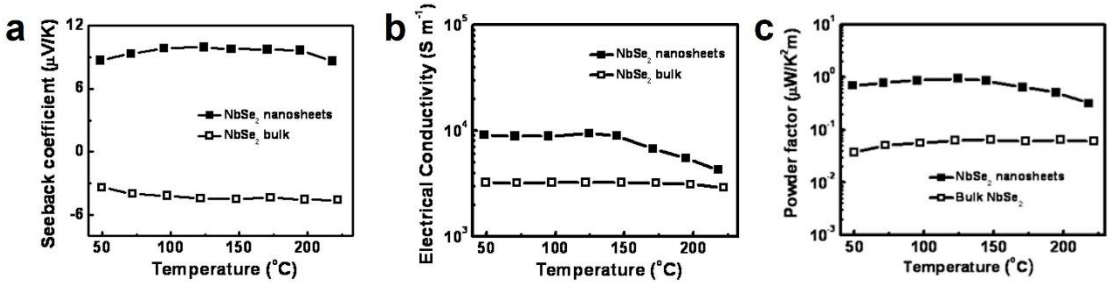
Supplementary Figure 6 SEM images of the large area TMDs nanosheets deposited on Si/SiO_2 substrate: (a, b) MoS_2, (c, d) TiS_2, (e, f) TaS_2 nanosheets. Note that TMDs nanosheets shows the darker contrast in comparison with SiO_2 substrate since the conductivity of TMD nanosheets are better than SiO_2 substrate.



Supplementary Figure 7 EDS of the exfoliated MoS_2 (a), WS_2 (b), TiS_2 (c), TaS_2 (d) nanosheets deposited on Si/SiO_2 substrate.



Supplementary Figure 8 Photoluminescence spectrum of a single-layer MoS_2 nanosheet deposited on Si/SiO_2 substrate. After the nanosheet was annealed at 450 oC in Ar gas for 2 h, it was excited with 488 nm laser in air at room temperature to give the PL spectrum. Adapted with permission from ref. [1].



Supplementary Figure 9 Temperature-dependent Seebeck coefficient (a), electrical conductivity (b) and powder factor (c) for $NbSe_2$ nanosheet and bulk material. Adapted with permission from ref. [2].

Supplementary Table 1 The molecular weights of different layered compounds, and the corresponding discharge capacities as lithium-ion batteries with one lithium ion intercalated, i.e., LiMN.

Layered compound	**Molecular weight ($g \cdot mol^{-1}$)**	**Capacity(1 Li) = LiMN ($mAh \cdot g^{-1}$)**
MoS_2	160	167.2
WS_2	248	107.9
TiS_2	112	238.9
TaS_2	245	109.2
ZrS_2	155	172.5
Graphite	12	2229.6
BN	25	1070.2
$NbSe_2$	251	106.6

Supplementary Table 2 Summary of the characteristics of the exfoliated 2D materials in this protocol.

Materials	MoS_2	WS_2	TiS_2	TaS_2	BN	$NbSe_2$
Thickness (nm)	1.0 ± 0.2	1.0	1.6 ± 0.2	0.9 ± 0.1	4.0	2.4
Lateral dimensions (μm)	0.3-3.0	0.4-1.0	0.3-3.0	0.3-3.0	1.0	1.0
Yield	92%	-	93%	93%	-	-

Supplementary References

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