# Supplementary Materials

Keys to Intimately Coupling Metal Chalcogenides with Carbon Nanonetwork for Potassium-Ion Storage

Weicai Zhang, Zhuohao Xie, Chaowen Lan, Yinghan Yang, Mingtao Zheng, Hang Hu, Yong Xiao, Yingliang Liu[*], Yeru Liang [*]

Correspondence to: tliuyl@scau.edu.cn, liangyr@scau.edu.cn

Supplementary Figures
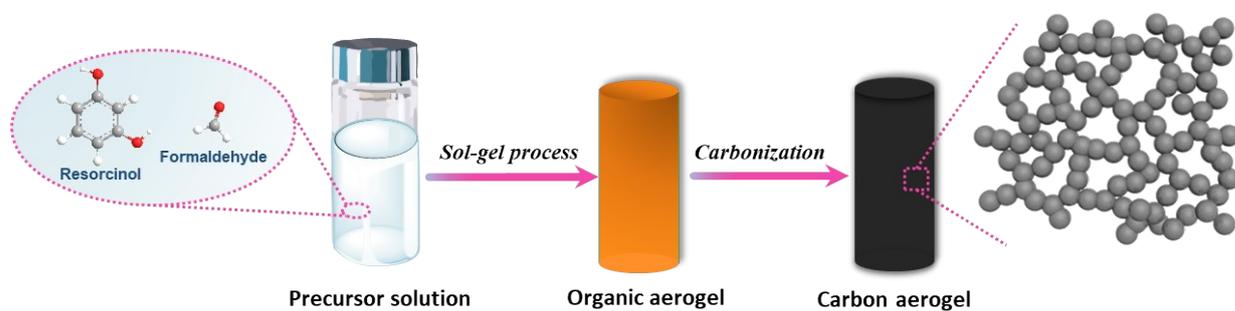
Figure S1. Schematic illustration for preparing CA.
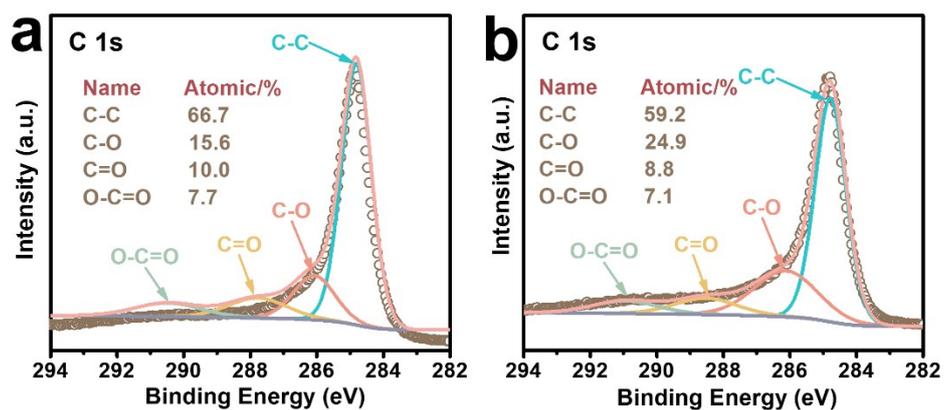
**Figure S2.** XPS spectra of C 1s spectrums in (a) CA and (b) O-CA.
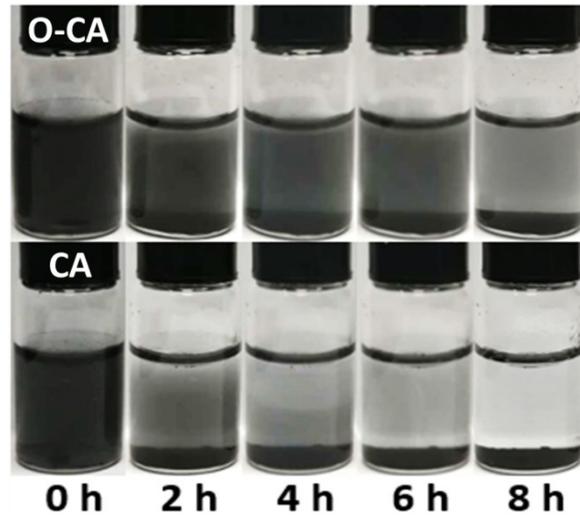
**Figure S3.** Digital photographs of CA and O-CA dispersed in deionized water.
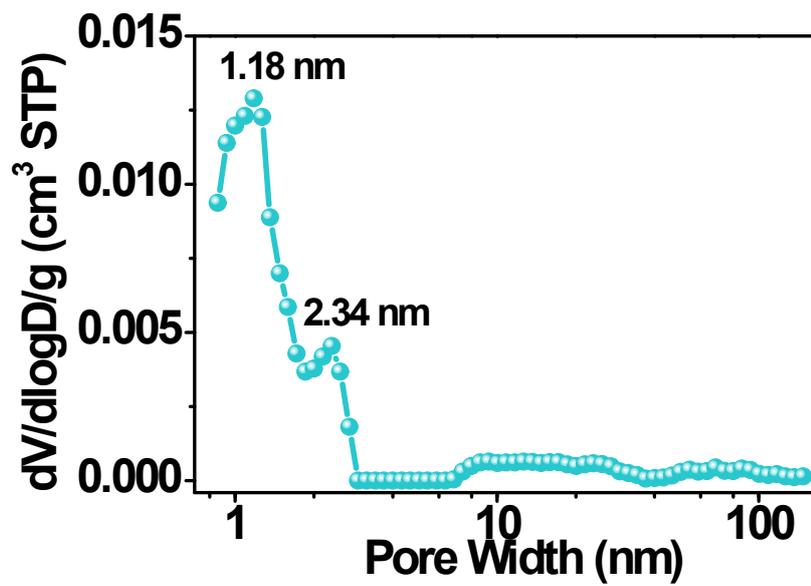
**Figure S4.** The pore size distribution of CA@MoSe$_2$.
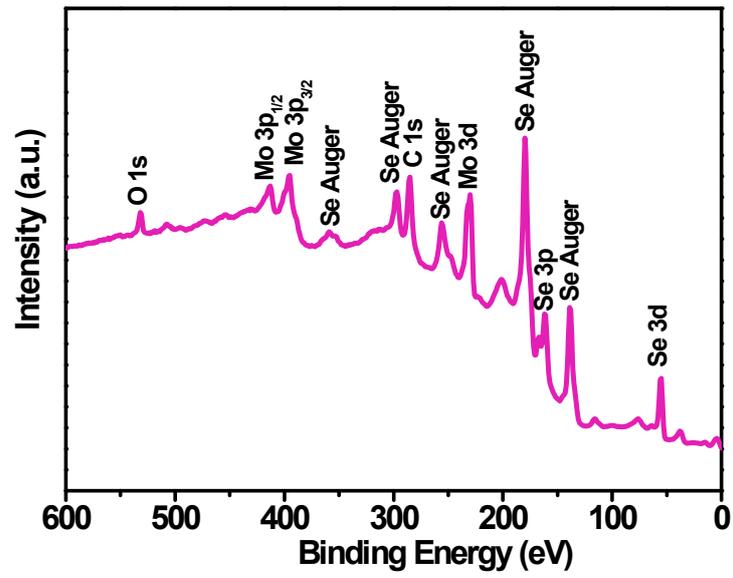
**Figure S5.** The XPS survey spectrum of CA@MoSe$_2$.
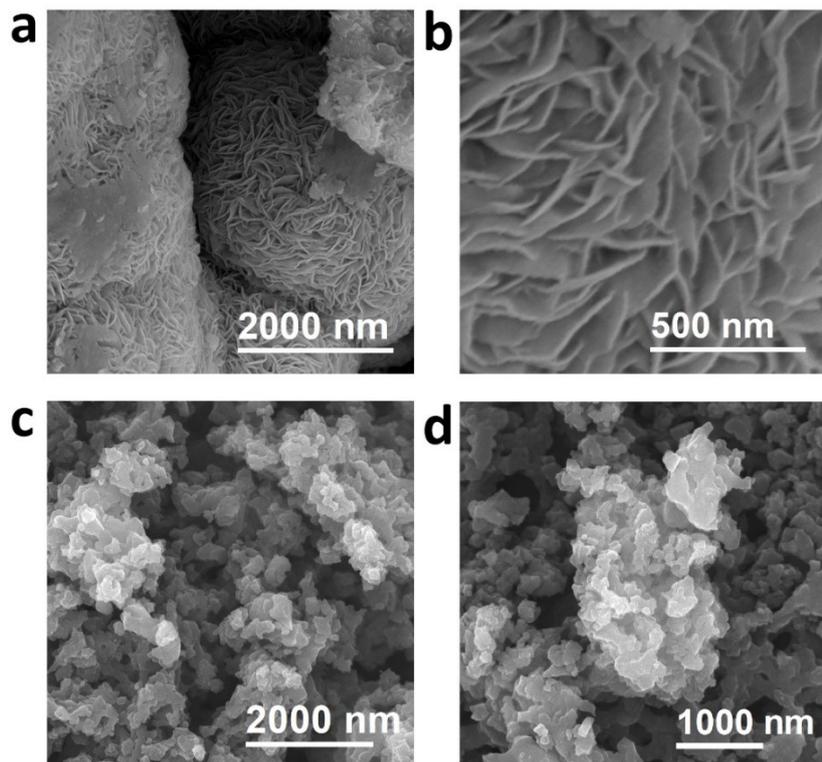
Figure S6. SEM images of (a, b) MoS$_2$ and (c, d) CA/MoS$_2$.
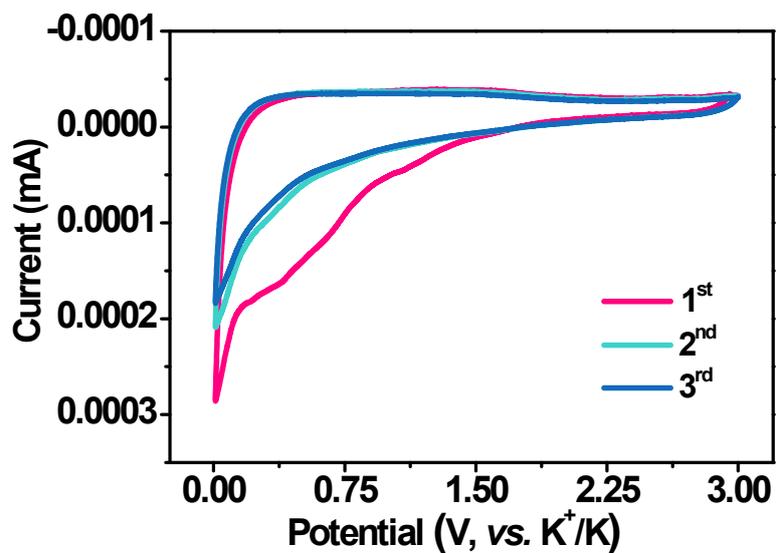
Figure S7. CV curves of CA@MoS$_2$ anode cycled at the 1st, 2nd, and 3rd between 0.01 and 3 V (vs. K$^+$/K) at a scan rate of 0.1 mV s^{-1}.
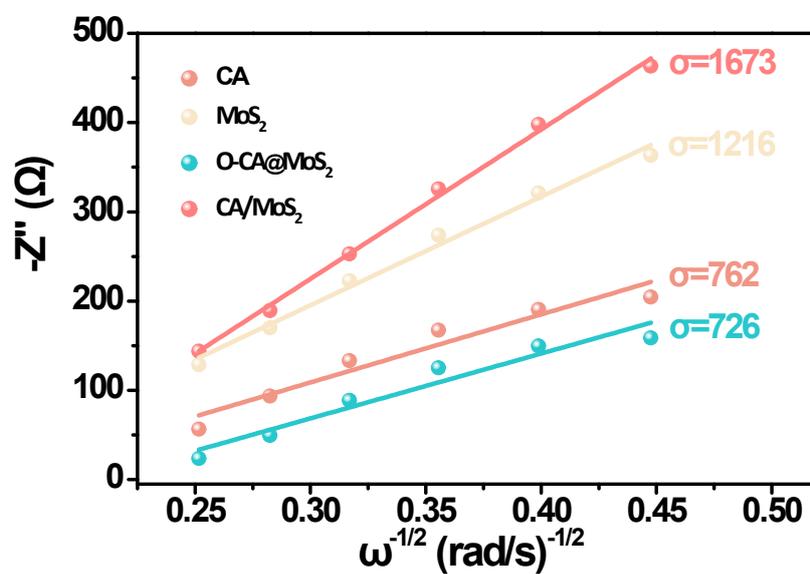
Figure S8. Plots of $\omega^{-1/2}$ versus-Z″ of different anodes in KIBs.

Supplementary Tables

Table S1. Chemical structure of CA and O-CA characterized by XPS.

Sample	C 1s (at. %)	O 1s (at. %)	C/O ratio (at. %)
CA	95.2	3.4	28.0
O-CA	92.8	5.7	16.3

Table S2. Binding energy and net electron transfer of graphene-Mo and graphene oxide-Mo.

Systems	E_{total} (eV)	$E_{substrate}$ (eV)	E_{Mo} (eV)	E_b (eV)	□q (e)
Carbon-Mo	-465.78	-461.07	-0.43	-4.28	0.38
Oxidized carbon-Mo	-583.00	-575.64	-0.43	-6.93	1.02

Table S3. Comparisons of the discharge capacity of different anodes for KIBs.

Anodes	Current density (mA g^{-1})	Discharge capacity (mAh g^{-1})	References
Mesoporous carbon	50	286	[1]
Graphitic carbon nanocage	14	137	[2]
Porous hard carbon microspheres	50	227	[3]
CoS@graphene	50	311	[4]
CoS/N-doped carbon	200	303	[5]
Fe-Mo selenide@N-doped carbon	200	298	[6]
Iron sulfide/carbon hybrid cluster	100	226	[7]
FeCl$_3$-intercalated expanded graphite	50	270	[8]
FeS$_2$@rGO	50	264	[9]
Sandwich-like MoS$_2$@SnO$_2$@C	50	312	[10]
P@nanotube-backboned mesoporous carbon	50	244	[11]
Phosphorus/carbon composite	50	324	[12]
ReS$_2$/N-doped carbon	50	253	[13]
Sb@N, P co-doped mesoporous carbon	50	266	[14]
3D hierarchically porous carbon/Sn	50	276	[15]
KTi$_2$(PO$_4$)$_3$@C	20	293	[16]
Metal-organic framework-MIL-125 (Ti)	10	208	[17]
Sn-interspersed MoS$_2$/C nanosheets	100	290	[18]
MoSe$_2$/N-Doped Carbon	100	258	[19]
Pistachio-shuck-like MoSe$_2$/C	200	322	[20]
CA@MoS$_2$	**100**	**389**	**This work**

Table S4. The kinetic parameters of different anodes.

Parameters	CA@MoS$_2$	CA	CA/MoS$_2$	MoS$_2$
R$_s$ (Ω)	2.3	3.6	4.0	30.5
R$_{ct}$ (Ω)	1619.1	1287.4	1923.0	1740.5
σ (Ω Hz$^{1/2}$)	726.3	762.3	1673.1	1215.9
D (10^{-20} cm^2 s^{-1})	8.1	7.4	1.5	2.9

Supplementary References

[1] W. Wang, J. Zhou, Z. Wang, L. Zhao, P. Li, Y. Yang, C. Yang, H. Huang, S. Guo, *Adv. Energy Mater.* **2018**, *8*, 1701648.

[2] B. Cao, Q. Zhang, H. Liu, B. Xu, S. Zhang, T. Zhou, J. Mao, W. K. Pang, Z. Guo, A. Li, J. Zhou, X. Chen, H. Song, *Adv. Energy Mater.* **2018**, *8*, 1801149.

[3] M. Chen, W. Wang, X. Liang, S. Gong, J. Liu, Q. Wang, S. Guo, H. Yang, *Adv. Energy Mater.* **2018**, *8*, 1800171.

[4] H. Gao, T. Zhou, Y. Zheng, Q. Zhang, Y. Liu, J. Chen, H. Liu, Z. Guo, *Adv. Funct. Mater.* **2017**, *27*, 1702634.

[5] Q. Yu, J. Hu, C. Qian, Y. Gao, W. Wang, G. Yin, *J. Solid State Electr.* **2019**, *23*, 27.

[6] J. Chu, Q. Yu, D. Yang, L. Xing, C.-Y. Lao, M. Wang, K. Han, Z. Liu, L. Zhang, W. Du, K. Xi, Y. Bao, W. Wang, *Appl. Mater. Today* **2018**, *13*, 344.

[7] Q. Yu, J. Hu, Y. Gao, J. Gao, G. Suo, P. Zuo, W. Wang, G. Yin, *J. Alloy. Compd.* **2018**, *766*, 1086.

[8] D. Li, M. Zhu, L. Chen, L. Chen, W. Zhai, Q. Ai, G. Hou, Q. Sun, Y. Liu, Z. Liang, S. Guo, J. Lou, P. Si, J. Feng, L. Zhang, L. Ci, *Adv. Mater. Interfaces* **2018**, *5*, 1800606.

[9] J. Xie, Y. Zhu, N. Zhuang, H. Lei, W. Zhu, Y. Fu, M. S. Javed, J. Li, W. Mai, *Nanoscale* **2018**, *10*, 17092.

[10] Z. Chen, D. Yin, M. Zhang, *Small* **2018**, *14*, 1703818.

[11] D. Liu, X. Huang, D. Qu, D. Zheng, G. Wang, J. Harris, J. Si, T. Ding, J. Chen, D. Qu, *Nano Energy* **2018**, *52*, 1.

[12] X. Wu, W. Zhao, H. Wang, X. Qi, Z. Xing, Q. Zhuang, Z. Ju, *J. Power Sources* **2018**, *378*, 460.

[13] M. Mao, C. Cui, M. Wu, M. Zhang, T. Gao, X. Fan, J. Chen, T. Wang, J. Ma, C. Wang, *Nano Energy* **2018**, *45*, 346.

[14] W. Zhang, W. Miao, X. Liu, L. Li, Z. Yu, Q. Zhang, *J. Alloy. Compd.* **2018**, *769*, 141.

[15] K. Huang, Z. Xing, L. Wang, X. Wu, W. Zhao, X. Qi, H. Wang, Z. Ju, *J. Mater. Chem. A* **2018**, *6*, 434.

[16] Z. Wei, D. Wang, M. Li, Y. Gao, C. Wang, G. Chen, F. Du, *Adv. Energy Mater.* **2018**, *8*, 1801102.

[17] Y. An, H. Fei, Z. Zhang, L. Ci, S. Xiong, J. Feng, *Chem. Commun.* **2017**, *53*, 8360.

[18] D. Yin, Z. Chen, M. Zhang, *J. Phys. Chem. Solids* **2019**, *126*, 72.

[19] J. Ge, L. Fan, J. Wang, Q. Zhang, Z. Liu, E. Zhang, Q. Liu, X. Yu, B. Lu, *Adv. Energy Mater.* **2018**, *8*, 1801477.

[20] W. Wang, B. Jiang, C. Qian, F. Lv, J. Feng, J. Zhou, K. Wang, C. Yang, Y. Yang, S. Guo, *Adv. Mater.* **2018**, *30*, 1801812.