Supporting Information

Porous $Al_{11}Ce_3$ intermetallics as effective sulfur host networks for stable lithium–sulfur batteries

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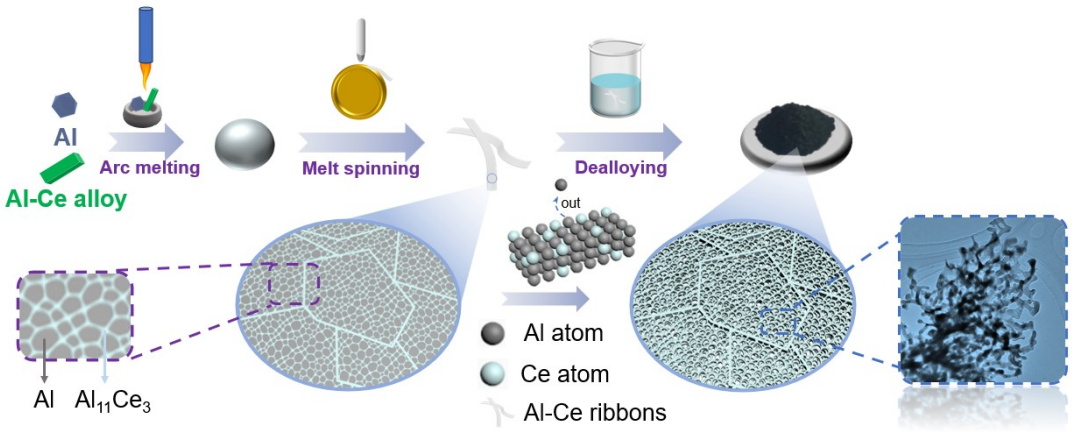

Fig. S1. Schematic diagram of the synthesis route.

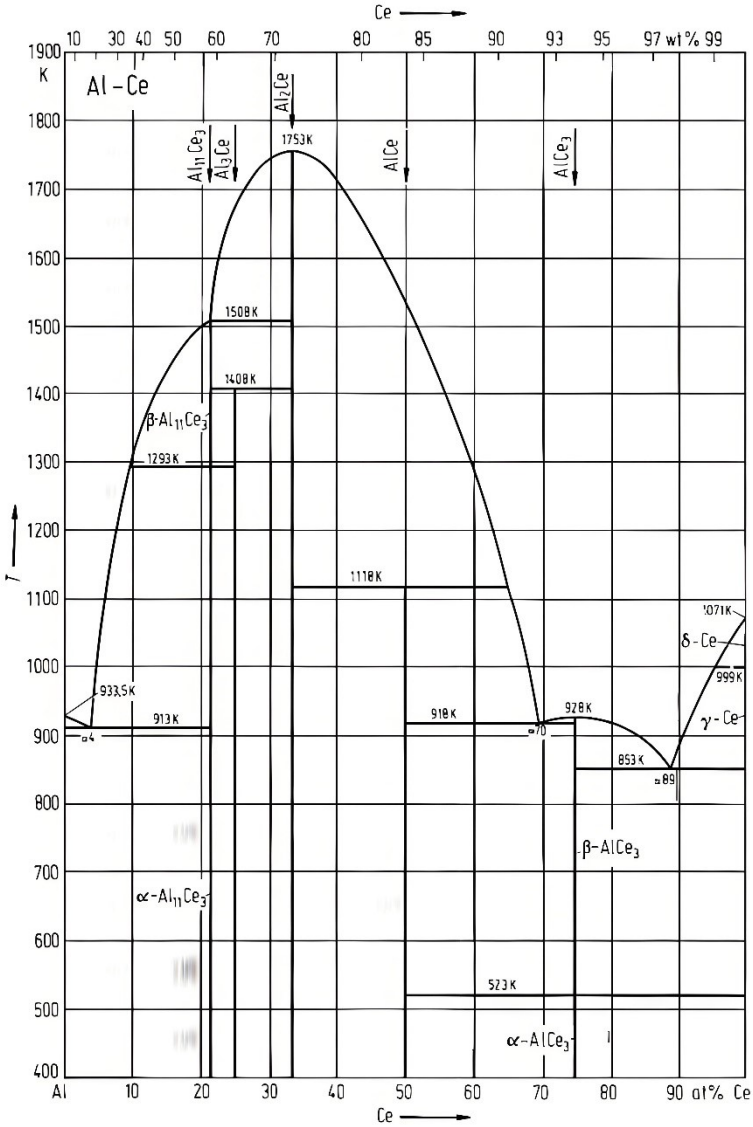

Fig. S2. Al-Ce binary phase diagram.

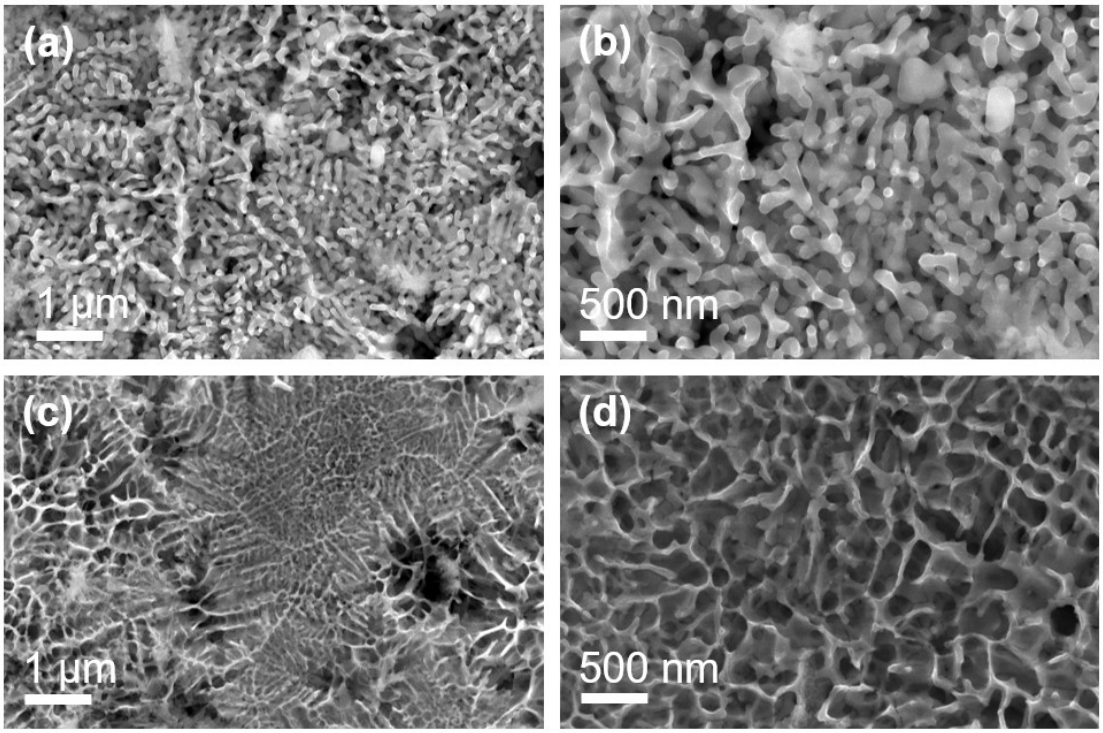

Fig. S3. SEM images of (a,b) D-$Al_{90}Ce_{10}$ and (c,d) D-$Al_{98}Ce_2$.

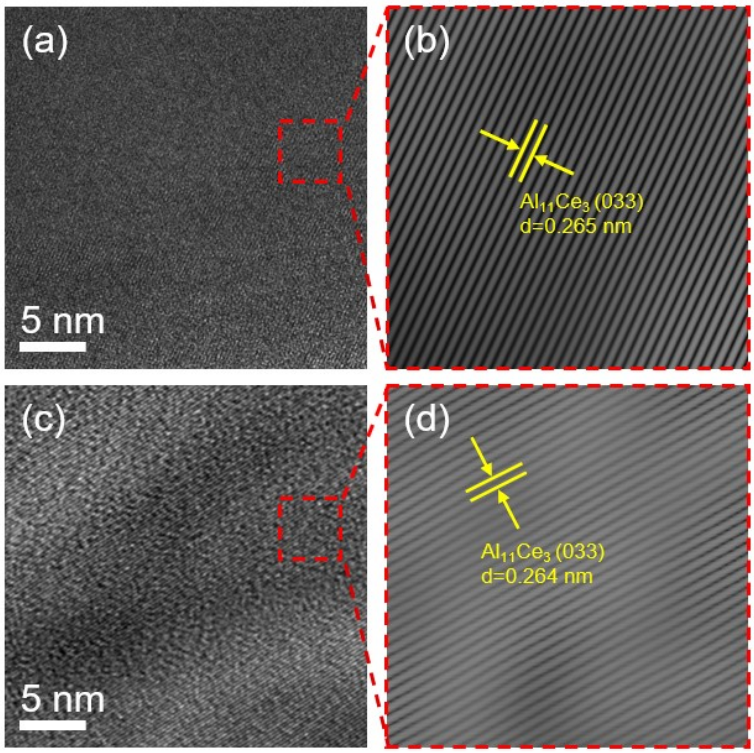

Fig. S4. HR-TEM images of D-$Al_{90}Ce_{10}$ (a,b) and D-$Al_{98}Ce_2$ (c,d).

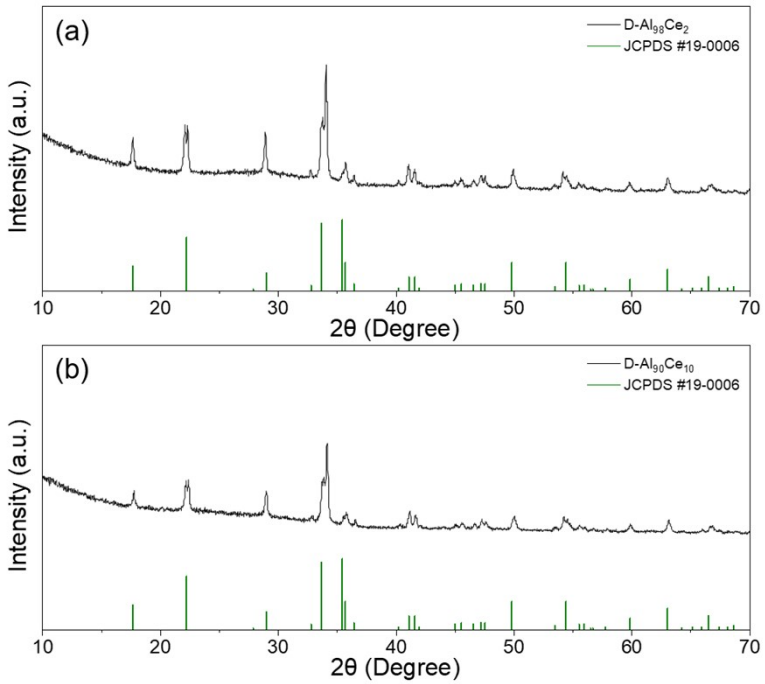

Fig. S5. XRD pattern of (a) D-$Al_{98}Ce_2$ and (b) D-$Al_{90}Ce_{10}$.

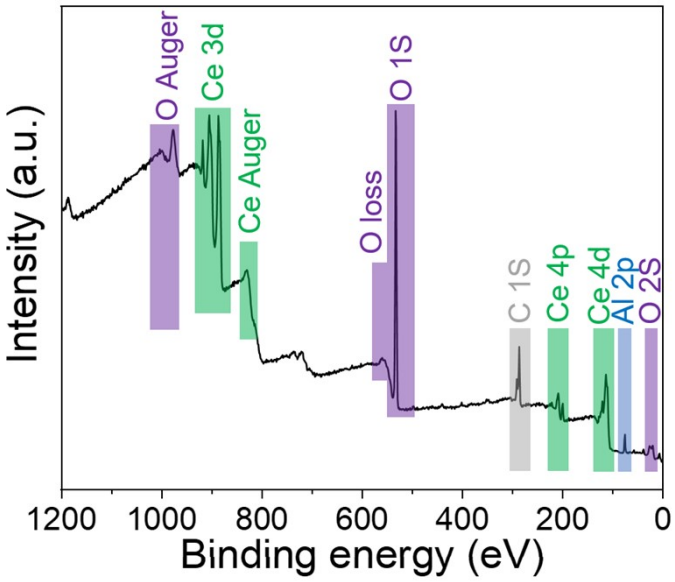

Fig. S6. XPS survey spectra of D-$Al_{96}Ce_4$.

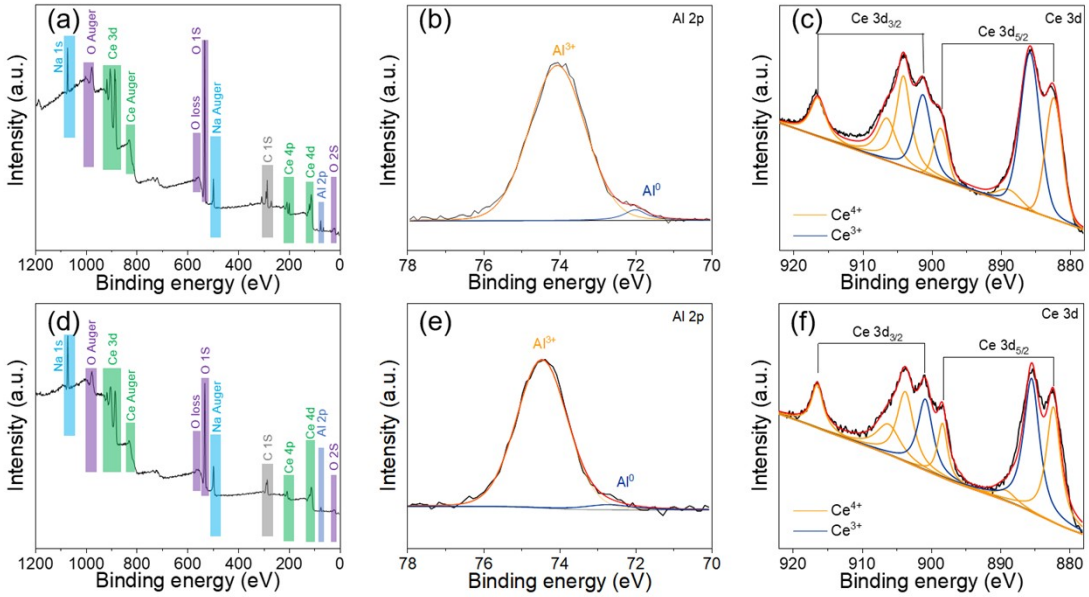

Fig. S7. (a-c) XPS spectra of D-$Al_{98}Ce_2$: (a) XPS survey spectra, (b) Al 2p, (c) Ce 3d; (d-f) XPS spectra of D-$Al_{90}Ce_{10}$: (d) XPS survey spectra, (e) Al 2p, (f) Ce 3d.

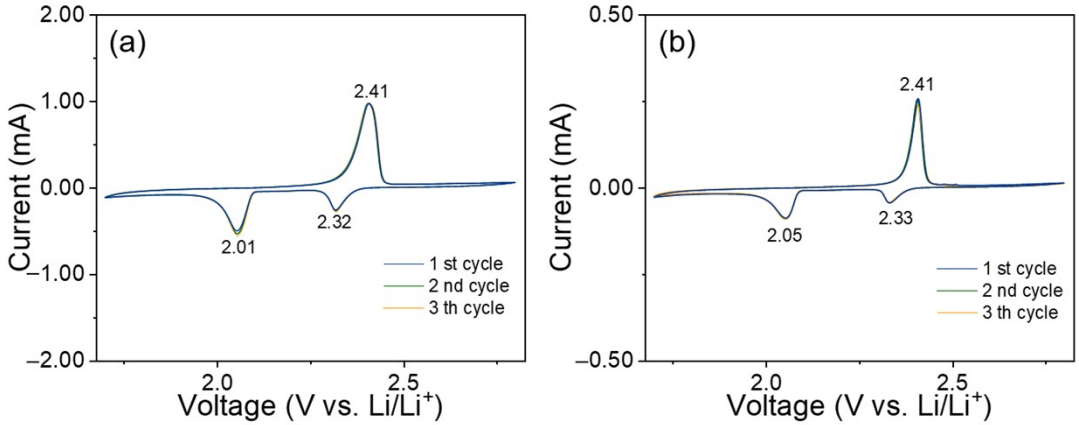

Fig. S8. CV profiles of (a) S@D-$Al_{90}Ce_{10}$ and (b) S@D-$Al_{98}Ce_2$ cathode at 0.1 mV s^{-1}.

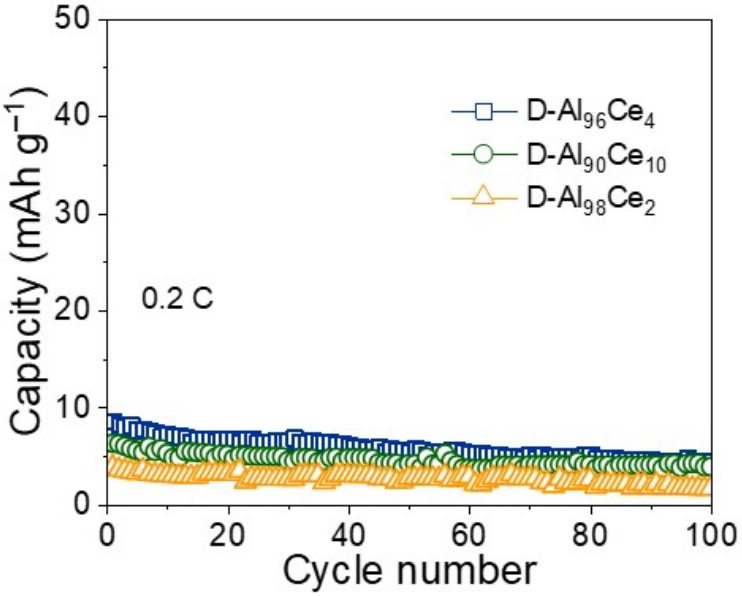

Fig. S9. Cycling performance of the D-$Al_{98}Ce_2$, D-$Al_{96}Ce_4$, and D-$Al_{90}Ce_{10}$ electrodes at the current density of 0.2 C

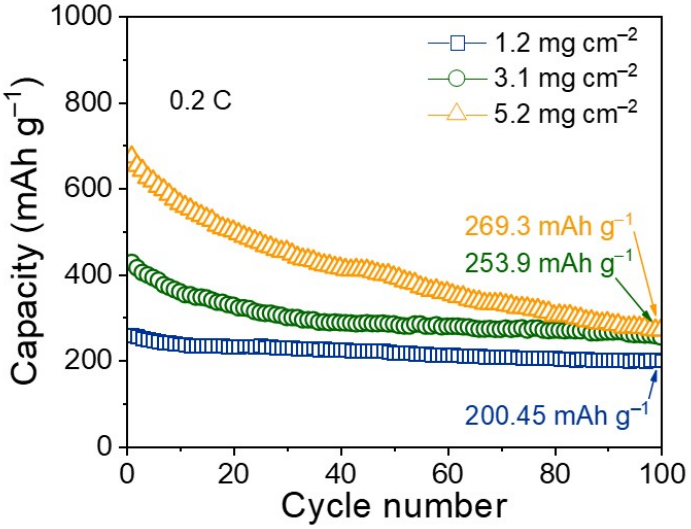

Fig. S10. Cycling performance of S@D-$Al_{96}Ce_4$ with different sulfur loadings from 1.2 to 5.2 mg cm^{-2} at 0.2 C.

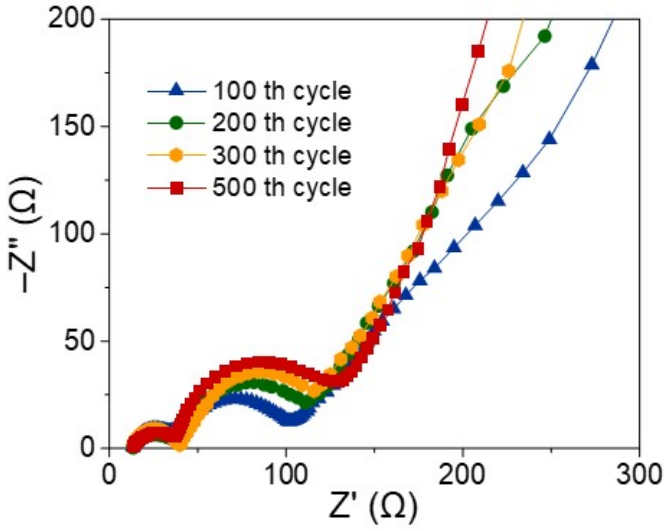

Fig. S11. EIS curves of S@D-$Al_{96}Ce_4$ after cycling at 1 C current density for different cycles.

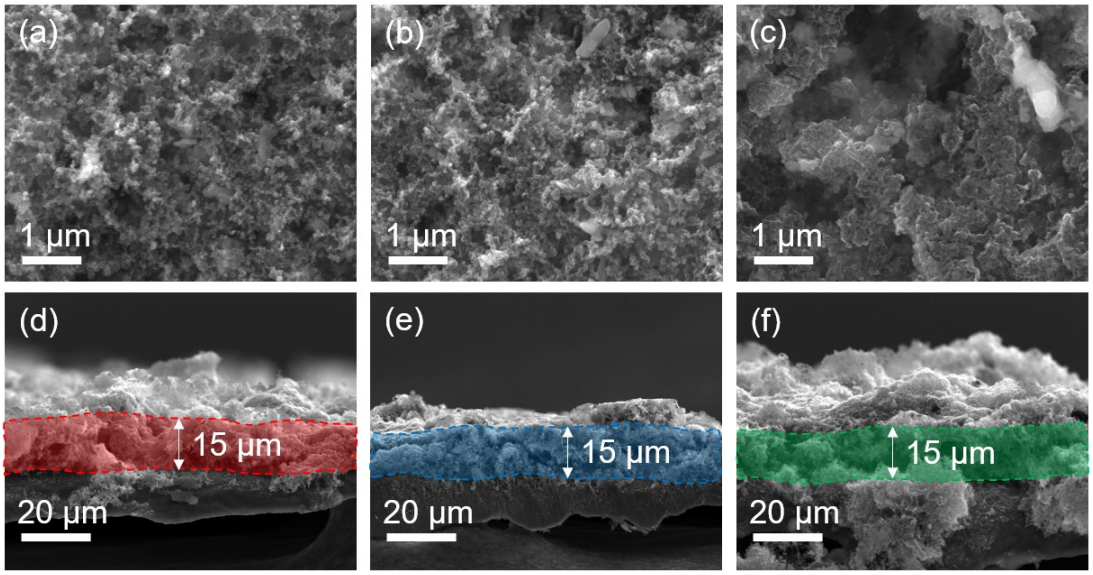

Fig. S12. SEM images of fresh (a) S@D-$Al_{96}Ce_4$, (b) S@D-$Al_{90}Ce_{10}$, and (c) S@D-$Al_{98}Ce_2$ cathodes.

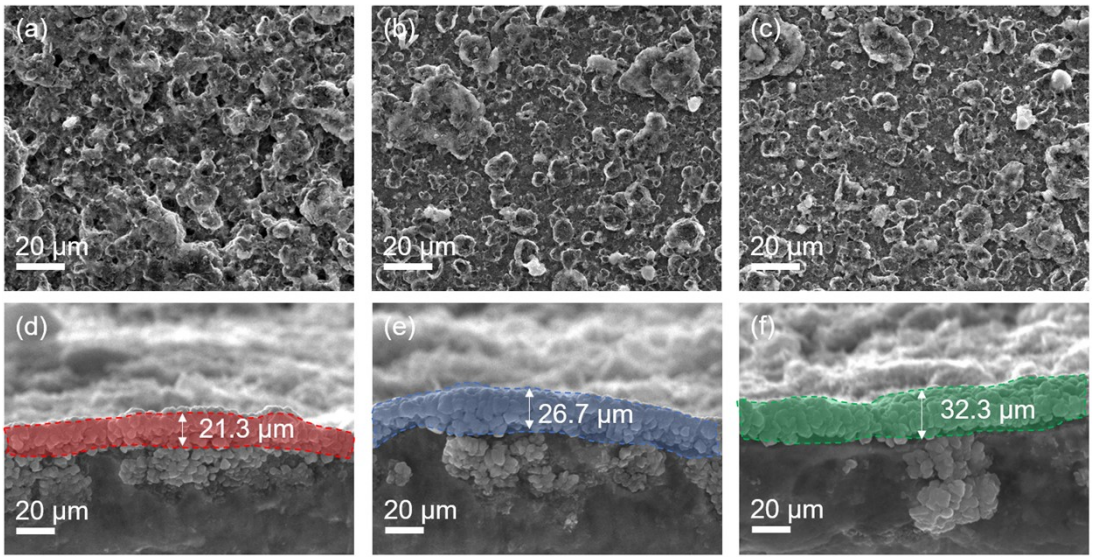

Fig. S13. SEM images of (a) S@D-$Al_{96}Ce_4$, (b) S@D-$Al_{90}Ce_{10}$, and (c) S@D-$Al_{98}Ce_2$ cathodes after cycling at 0.2 C for 100 cycles.

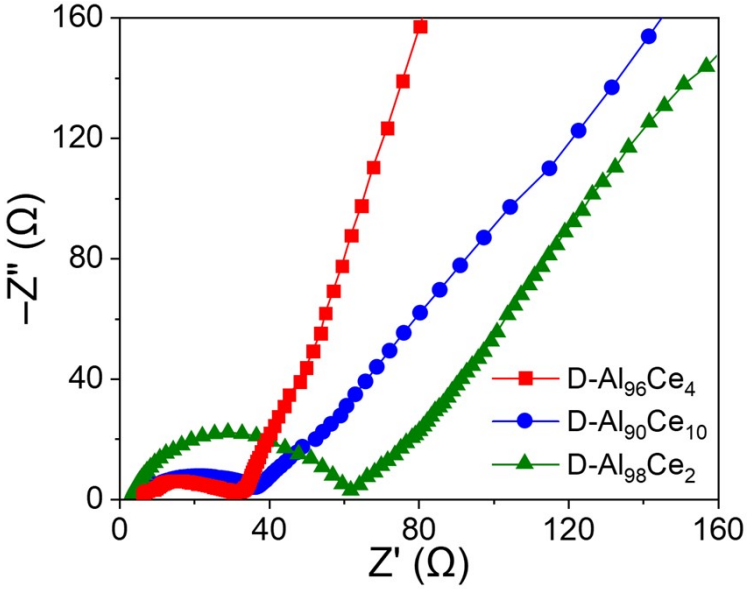

Fig. S14. EIS spectra of symmetric cells with D-$Al_{98}Ce_2$, D-$Al_{96}Ce_4$, and D-$Al_{90}Ce_{10}$ electrodes

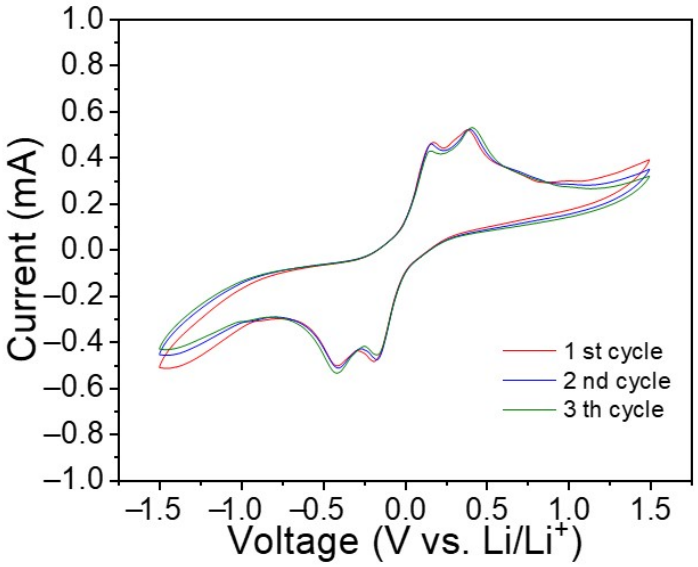

Fig. S15. CV curves of symmetric cells with D-$Al_{96}Ce_4$ electrodes.

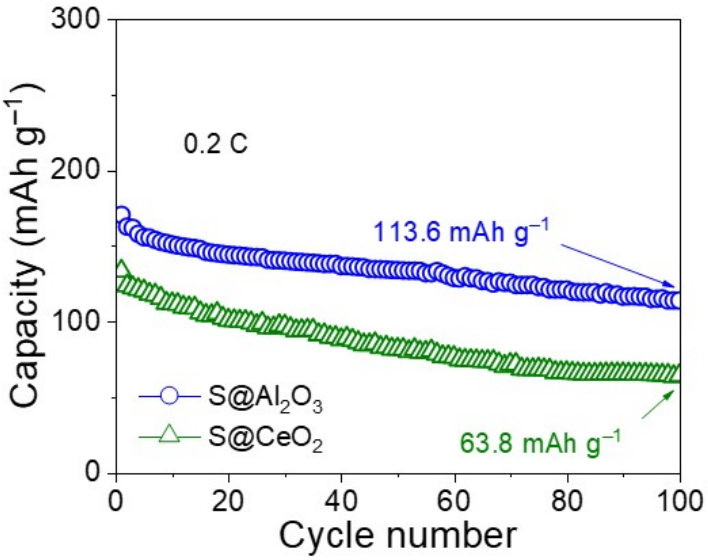

Fig. S16. Cycling performance of the S@Al_2O_3 and S@CeO_2 cathodes at the current density of 0.2 C

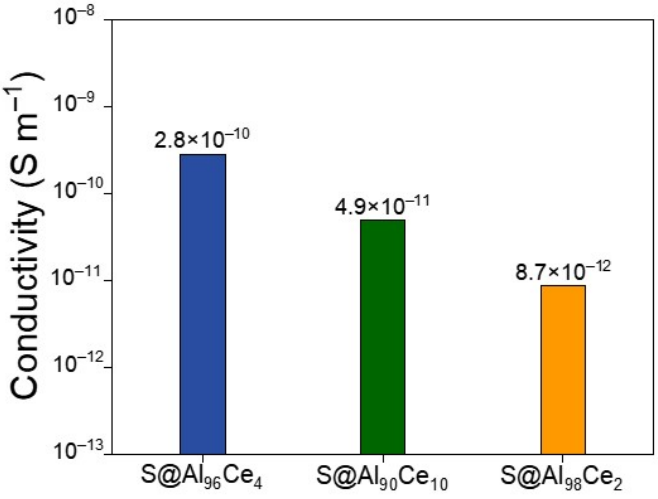

Fig. S17. Electrical conductivity of the S@D-$Al_{98}Ce_2$, S@D-$Al_{96}Ce_4$, and S@D-$Al_{90}Ce_{10}$ cathodes.

Table S1. R_{ct} values of EIS curves of different samples.

Sample	**R_{ct}**
S@D-$Al_{96}Ce_4$	53.3
S@D-$Al_{90}Ce_{10}$	54.1
S@D-$Al_{98}Ce_2$	83.5

Table S2. R_{ct} values of EIS curves of S@D-$Al_{96}Ce_4$ with different cycles.

Cycle number	**R_{ct}**
100	61.7
200	70.8
300	75.7
500	89.8

Table S3 Comparison of electrochemical performance.

Material	**Current density (c)**	**Cycle**	**Reversible capacity (mAh g^{-1})**	**Reference**
CeO_2@CNT/S	0.2	100	723	S1
CeO_{2-x}-CNT/S	0.5	600	877	S2
Zn@NPC-CeO_2-2	2	200	569.3	S3
Al_2O_3@C	0.1	200	302	S4
g-C_3N_3/CNTs	1	500	803.4	S5
V_2O_3@C-CNTs	0.5	500	715.4	S6
Co_1-CoS_2@CNT@C	1	500	555.8	S7
S@D-$Al_{96}Ce_4$	0.2	100	204.83	This work
	1	500	140	

References

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