Supporting Information

Polydopamine-Modified Carboxymethyl Cellulose as Advanced Polysulfide Trapping Binder

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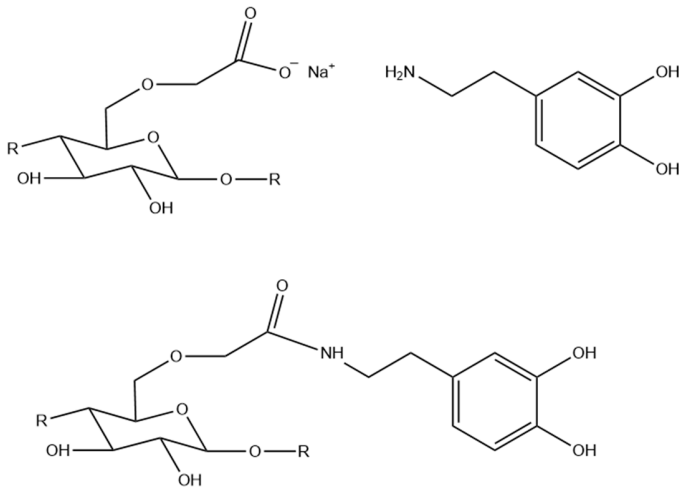


Figure S1. Molecular schematic showing the functionalization of CMC carboxylate group via amidation and grafting of dopamine.

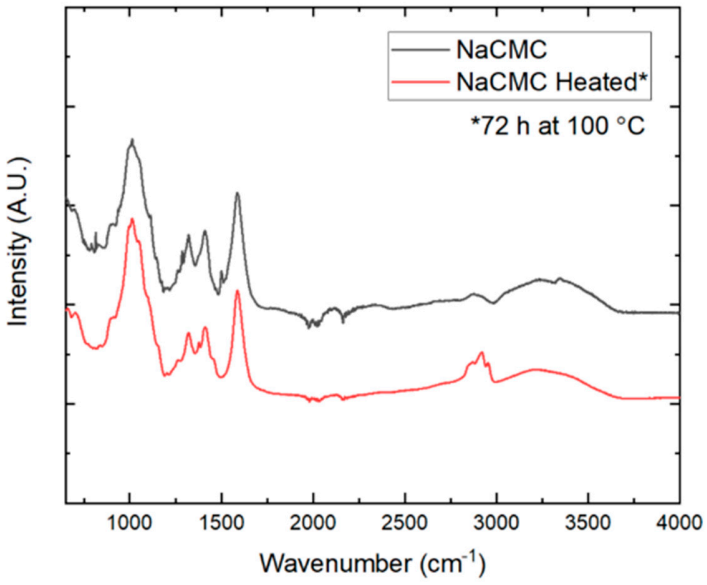


Figure S2. FTIR spectra of CMC before and after heating. The sample does not show any clear signs of degradation.

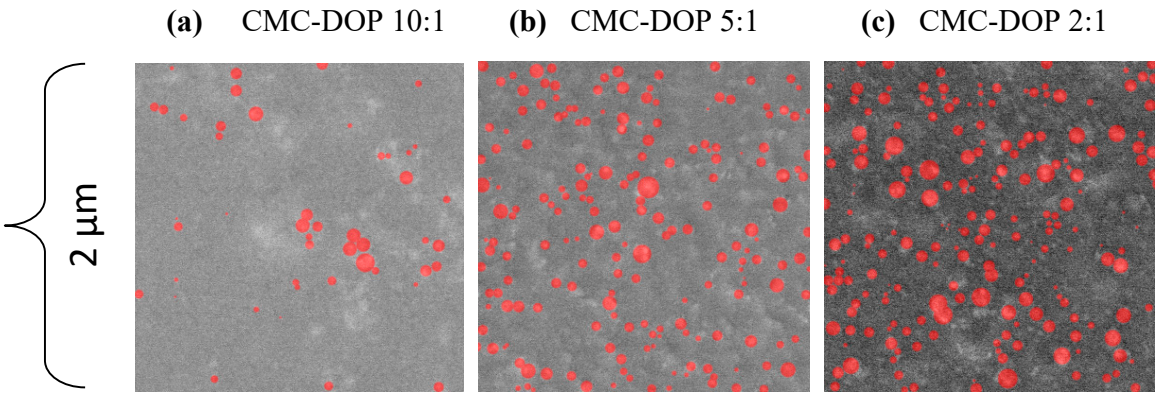


Figure S3. Cropped images from Figure 1. Each image represents 2x2 µm in scale. The red markers indicate the particles which were counted for analysis in Table S1 and Figure S4.

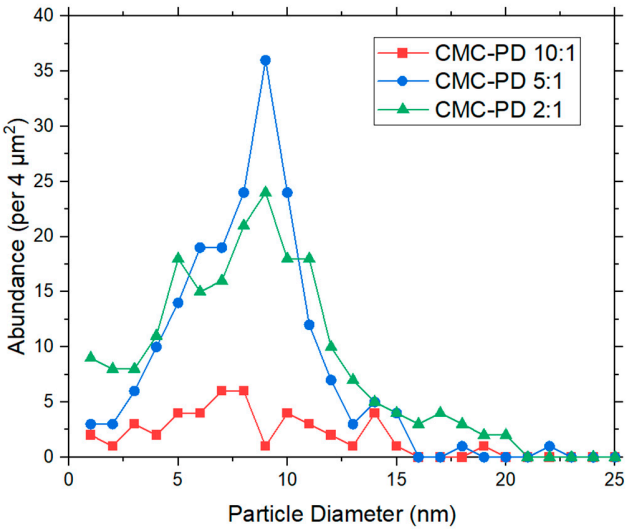


Figure S4. Size distribution of PD nanoparticles.

Table S1. Analysis of a 4 µm^2 area of SEM images from Figure S3. Error represents the standard deviation of all identified particles. Volume and area calculations assume a spherical morphology.

	Total Particles (#)	Average Diameter (nm)	Cumulative Volume (µm³)	Cumulative Area (µm²)
CMC-DOP 10:1	45	49.5 ± 21.9	0.0053	0.45
CMC-DOP 5:1	190	52.1 ± 17.1	0.0198	1.85
CMC-DOP 2:1	206	53.5 ± 23.6	0.0275	2.25

Table S2. Summary of quantitative EDS results for pristine cathodes.

Pristine Sulfur Cathode								
Wt.%	Li	C	N	O	F	Na	S	Cl
CMC	ND	80.89	ND	4.48	0.12	0.82	13.68	ND
CMC-DOP 10:1	ND	80.8	0.05	5.87	0.1	1.16	12.69	0.05
CMC-DOP 5:1	ND	78.72	1.19	6.47	0.05	1.01	12.5	0.06
CMC-DOP 2:1	ND	79.4	1.46	8.04	0.02	1.51	8.53	ND

(a) (b) (c)

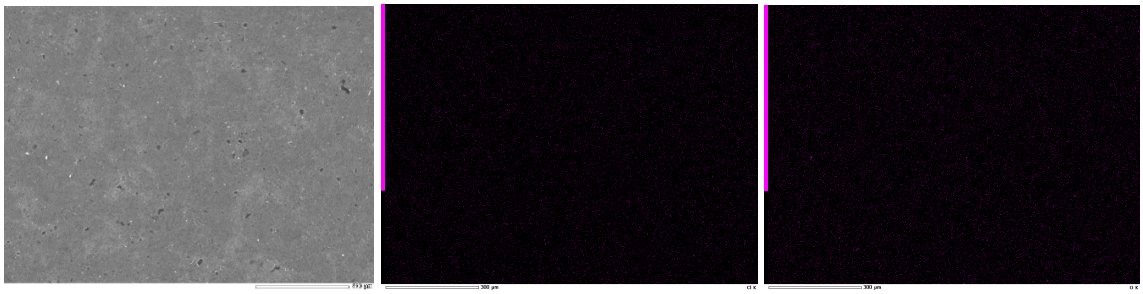


Figure S5. (a) SEM of foil on CMC electrode with EDS mapping for (b) Cl and (c) O.

(a) (b) (c)

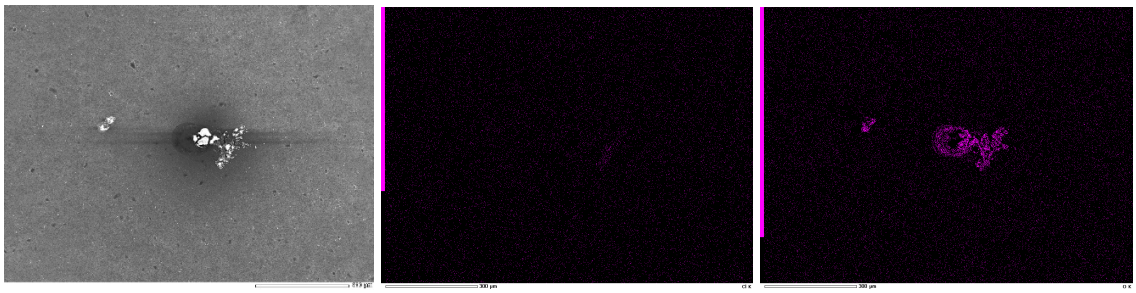


Figure S6. (a) SEM of foil on CMC-DOP 10:1 electrode with EDS mapping for (b) Cl and (c) O.

(a) (b) (c)

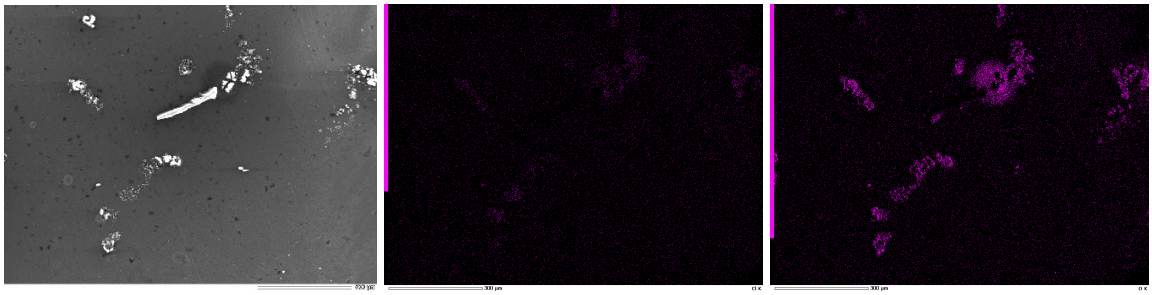


Figure S7. (a) SEM of foil on CMC-DOP 5:1 electrode with EDS mapping for (b) Cl and (c) O.

(a) (b) (c)

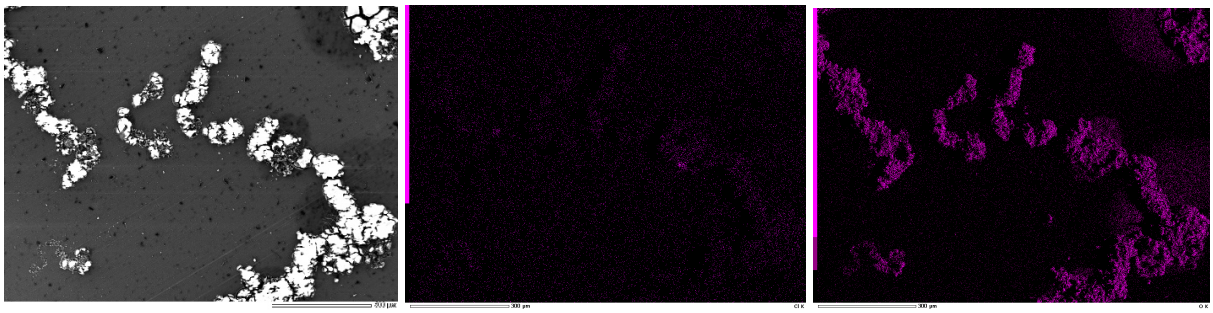


Figure S8. (a) SEM of foil on CMC-DOP 2:1 electrode with EDS mapping for (b) Cl and (c) O.

Table S3. Summary of all Z-fit parameters to EIS data from LSBs prior to cycling in Figure 5. Equivalent capacitance (C_{eq}) is calculated by the following equation, $C_{eq,i} = CPE_i^{\left(\frac{1}{a}\right)} R_i^{\left(\frac{1}{a-1}\right)}$.

	R_e (Ω)	R_{int} (Ω)	CPE_{int} (F $s^{(a-1)}$)	a_{int}	$C_{eq,int}$ (F)	R_{ct} (Ω)	CPE_{dl} (F $s^{(a-1)}$)	a_{dl}	$C_{eq,dl}$ (F)
CMC	3.00	14.37	3.83E-07	1	3.83E-07	1104	4.60E-06	0.8642	2.01E-06
CMC-DOP 10:1	2.98	34.91	8.16E-06	0.8442	1.81E-06	693	4.79E-07	0.9808	4.09E-07
CMC-DOP 5:1	3.94	27.99	6.32E-06	0.8395	1.21E-06	1116	5.22E-07	0.989	4.80E-07
CMC-DOP 2:1	2.06	28.10	8.50E-06	0.8324	1.59E-06	800	2.52E-07	1	2.52E-07

Table S4. Summary of all Z-fit parameters to EIS data from LSBs after 500 cycles in Figure 5b. Equivalent capacitance (C_{eq}) is calculated by the following equation, $C_{eq,i} = CPE_i^{\left(\frac{1}{a}\right)} R_i^{\left(\frac{1}{a-1}\right)}$.

	R_e (Ω)	R_{int} (Ω)	CPE_{int} (F $s^{(a-1)}$)	a_{int}	$C_{eq,int}$ (F)	R_{ct} (Ω)	CPE_{dl} (F $s^{(a-1)}$)	a_{dl}	$C_{eq,dl}$ (F)	CPE_{dif} (F $s^{(a-1)}$)	a_{dif}
CMC	7.05	2.49	3.02E-05	0.7097	6.20E-07	14.12	2.07E-05	0.7661	1.73E-06	2.67E-03	0.7389
CMC-DOP 10:1	7.01	1.3	6.43E-05	0.9738	4.99E-05	9.5600	5.00E-05	0.6538	8.72E-07	1.33E-03	0.8736
CMC-DOP 5:1	3.45	0.86	3.50E-06	1	3.50E-06	4.83	3.89E-05	0.7639	2.74E-06	1.39E-03	0.8506
CMC-DOP 2:1	6.15	10.41	9.42E-06	1	9.42E-06	33.8300	1.07E-05	0.6919	3.13E-07	1.54E-03	0.6332

Table S5. Summary of all quantitative EDS measurements for cycled sulfur cathodes from Figure 4.

Cycled Sulfur Cathode								
Wt.%	Li	C	N	O	F	Na	S	Cl
CMC	ND	56.58	1.73	33.88	1.53	0.36	5.85	ND
CMC-PD 10:1	ND	42.91	0.89	44.76	1.49	0.99	8.9	0.03
CMC-PD 5:1	ND	41.59	0.1	43.47	1.21	0.84	12.15	0.27
CMC-PD 2:1	ND	63.29	2.27	26.85	0.66	1.28	3.23	0.52

Table S6. Summary of all quantitative EDS measurements for cycled Li anodes from Figure 4.

Li Metal Anode								
Wt.%	Li	C	N	O	F	Na	S	Cl
Pristine	ND	24.89	2.93	68.64	1.17	ND	1.47	0.13
CMC	ND	12.23	7.17	35.24	26.09	0.18	19.09	ND
CMC-PD 10:1	ND	15.81	10.15	20.26	38	0.09	15.77	ND
CMC-PD 5:1	ND	10.07	4.83	52.42	18.87	ND	13.82	ND
CMC-PD 2:1	ND	14.01	4.85	40.21	9.81	0.85	30.18	ND

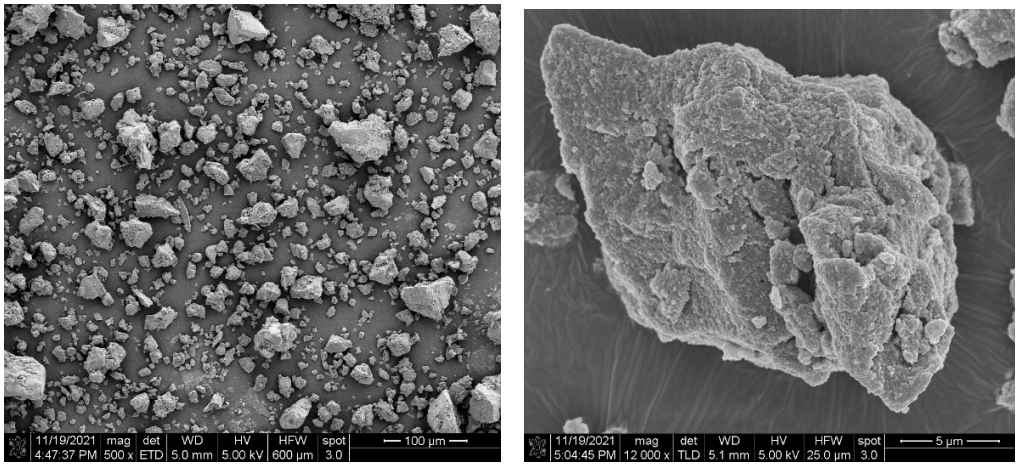


Figure S9. Ball-milled 2:1 Sulfur/Carbon composite sifted to 75 µm. Material tends to aggregate into large clumps.

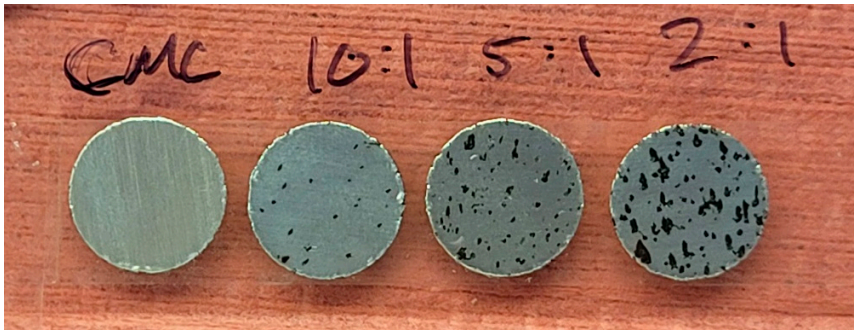


Figure S10. Cathode disks which have been wiped with a damp paper towel. Corrosion from HCl in the electrode slurry has caused pitting in the Al foil, where carbon remains trapped.

Figure S11. Post-mortem photographs taken of Li anode after 500 cycles in Figure 4.

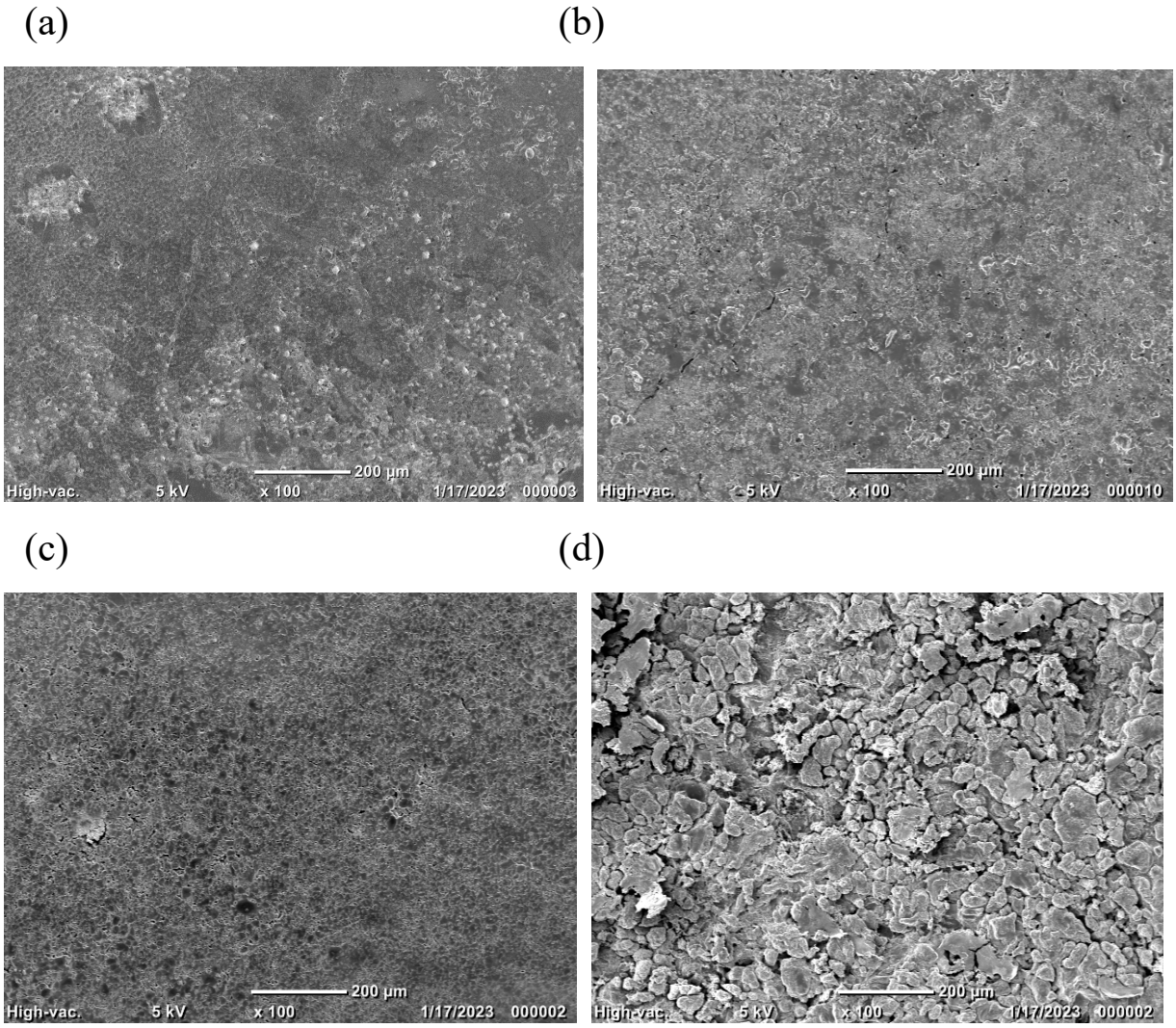


Figure S12. Additional zoomed out SEM images of cycled Li anodes from Figure 6 for (a) CMC, (b) CMC-DOP 10:1, (c) CMC-DOP 5:1, and (d) CMC-DOP 2:1.

(a) (b)

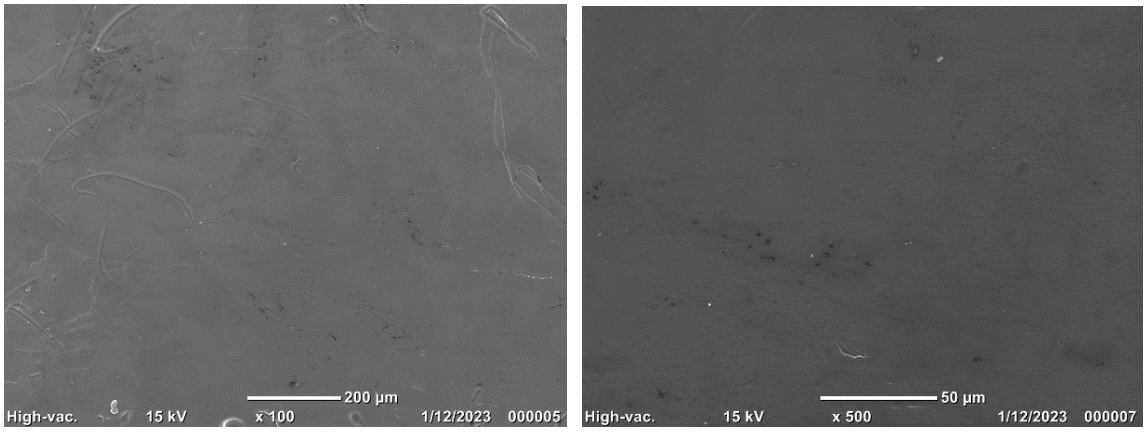
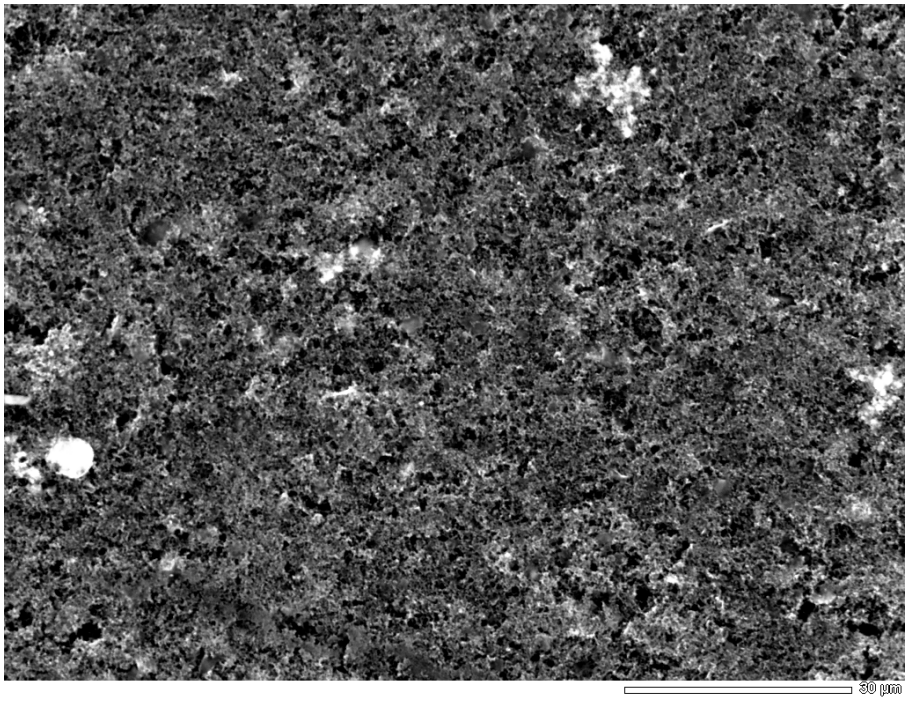


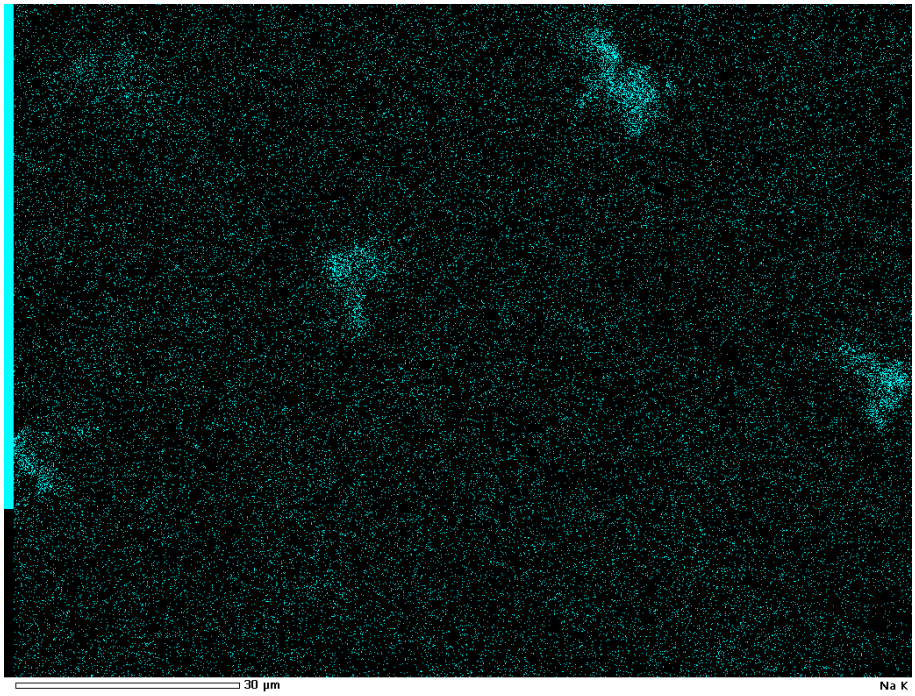
Figure S13. SEM Images of Pristine Li at (a) x100 and (b) x500 magnification.

Figure S14. SEM Images of (a) CMC-DOP 2:1 cathode with EDS mapping for (b) Na, (c) Cl, (d) and O.

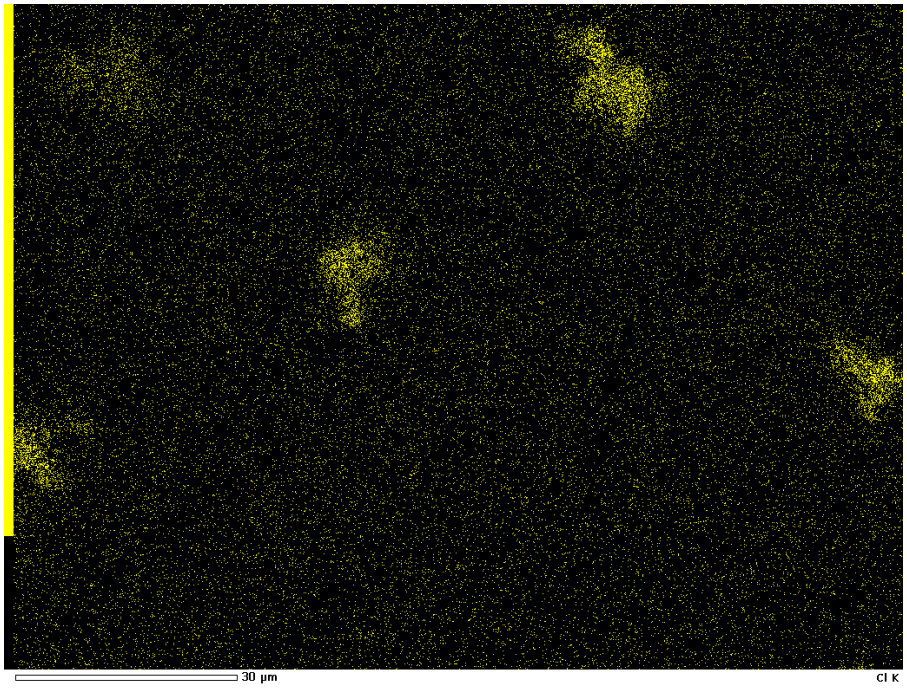
(a)



(b)



(c)



(d)

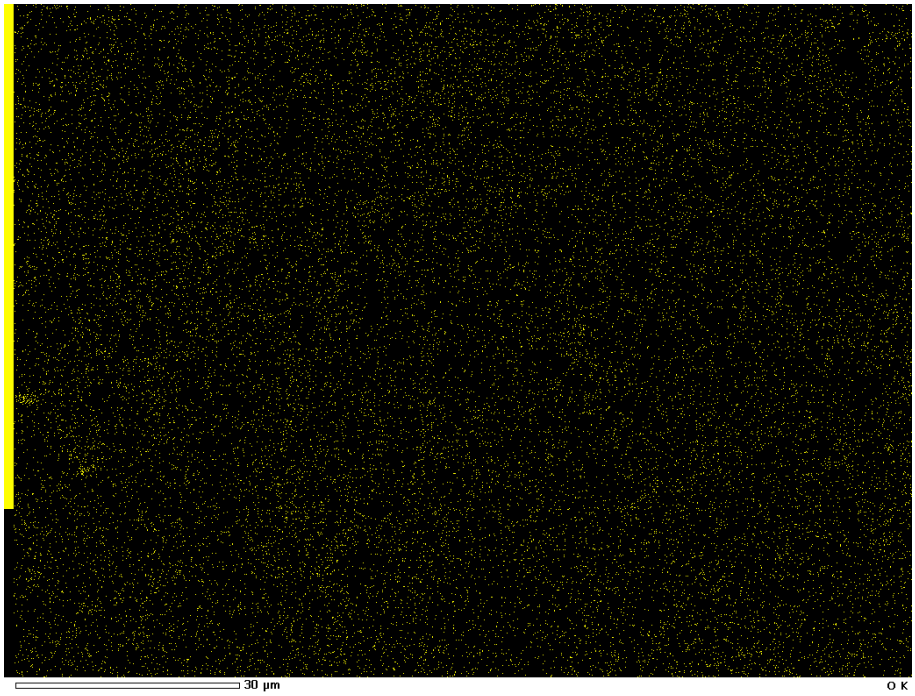
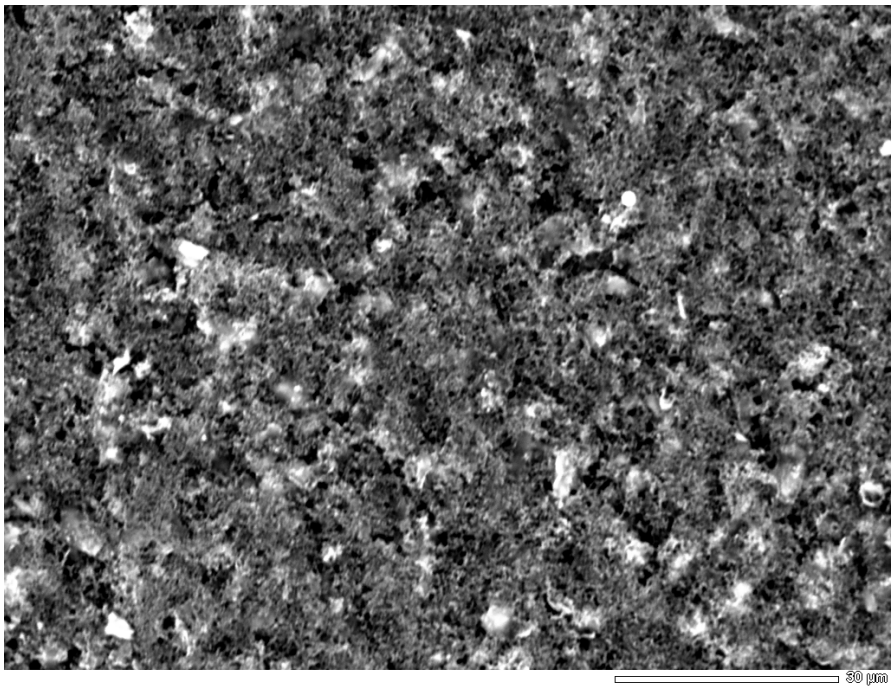
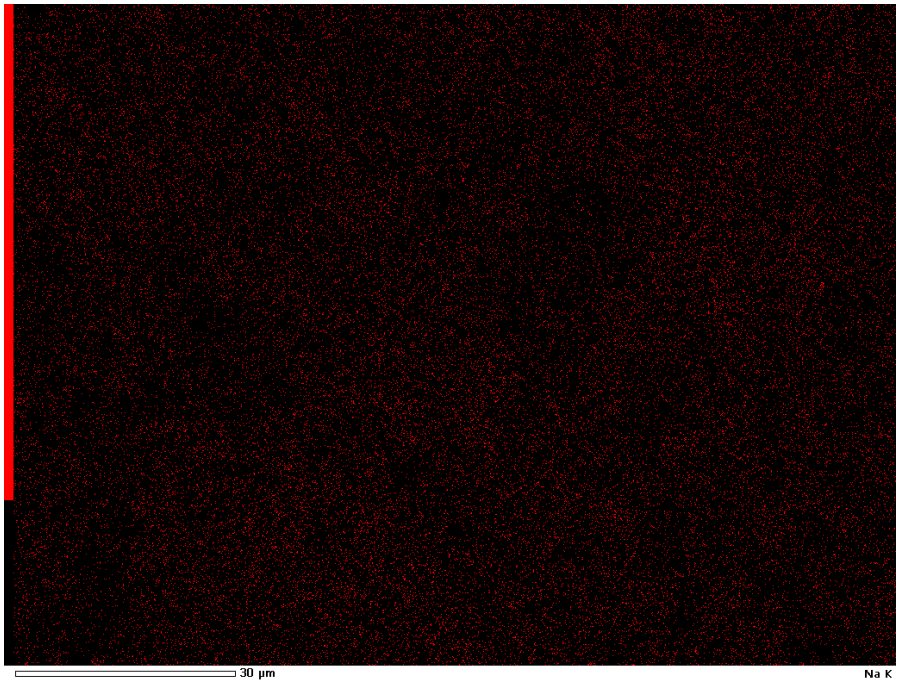


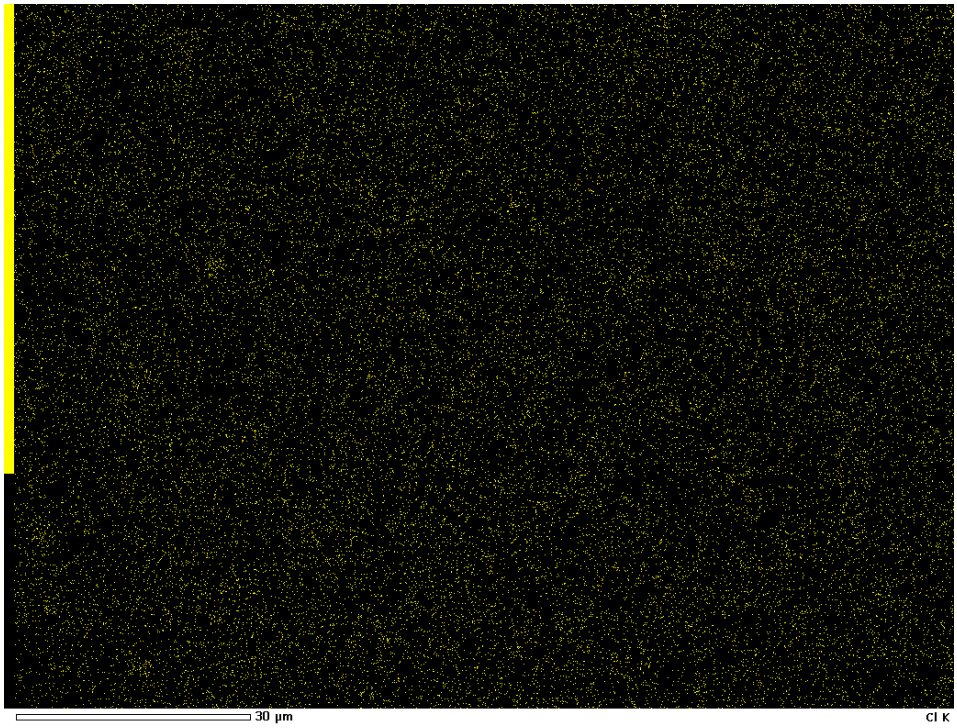
Figure S15. SEM Images of (a) CMC-DOP 5:1 cathode with EDS mapping for (b) Na, (c) Cl, (d) and O.

(a)



(b)

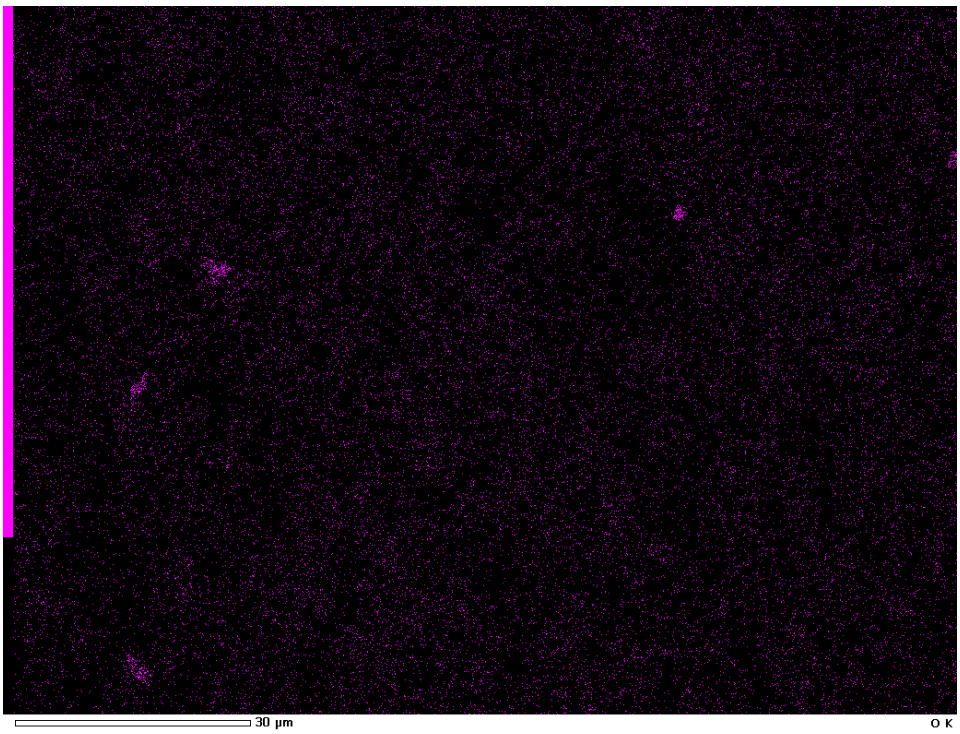




(c)

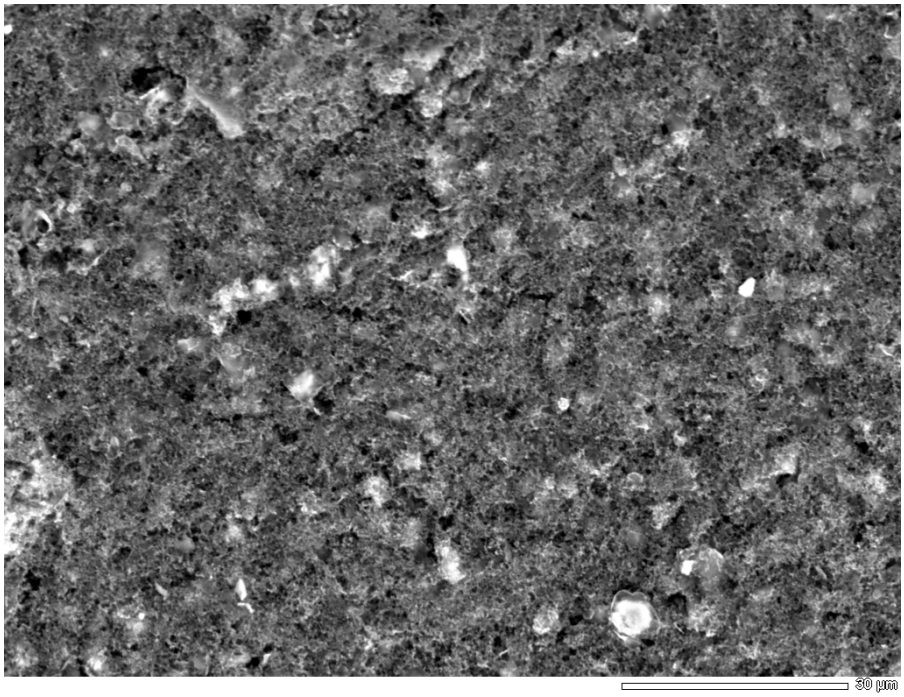
(d)

Figure S16. SEM Images of (a) CMC-DOP 10:1 cathode with EDS mapping for (b) Na, (c) Cl,

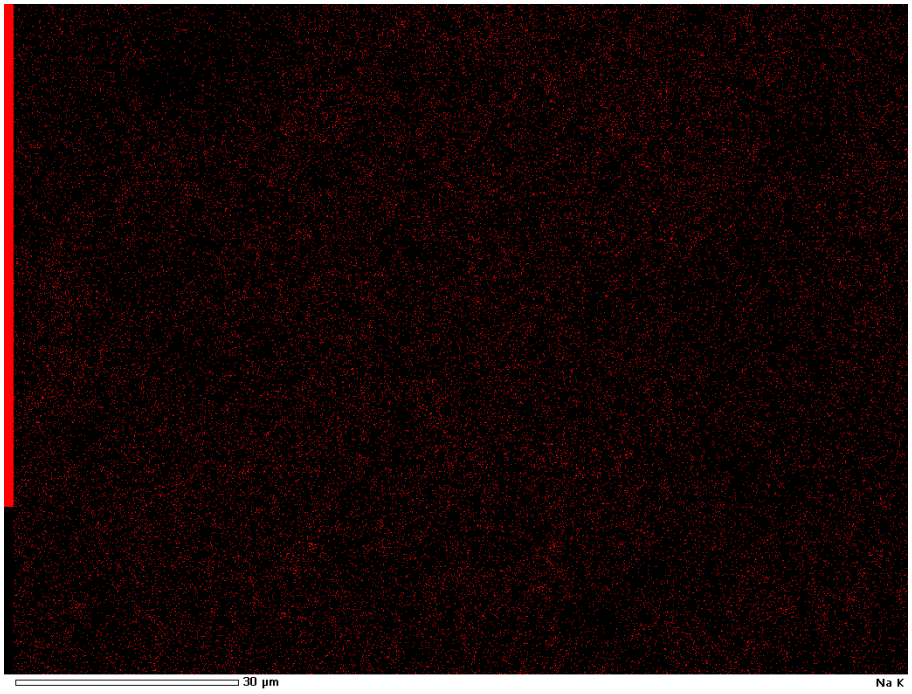


(d) and O.

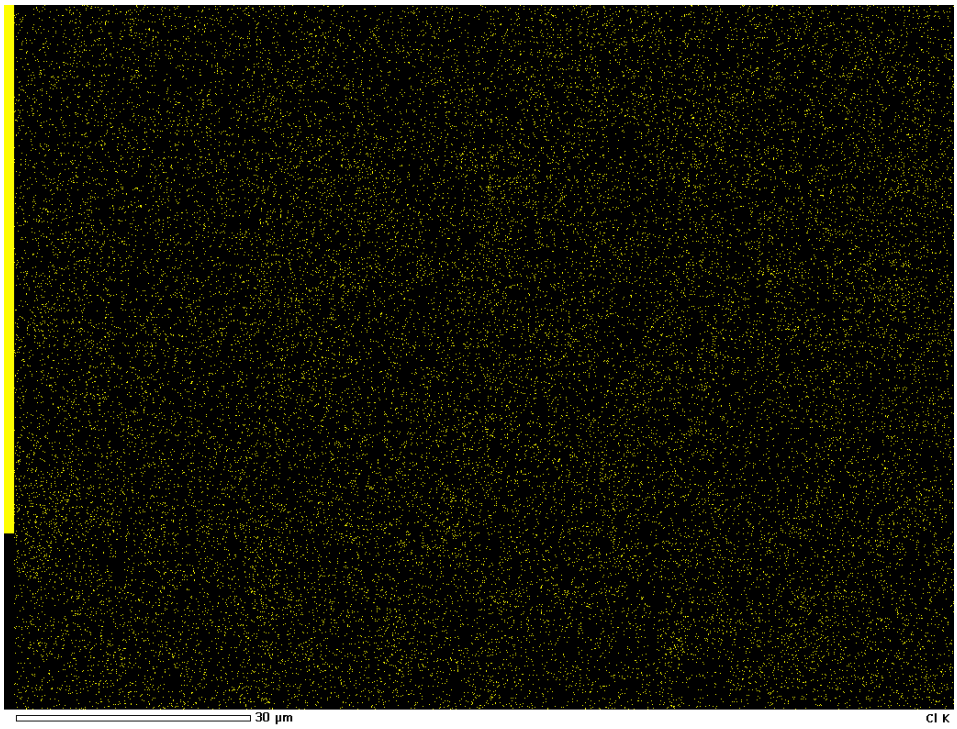
(a)



(b)



(c)



(d)

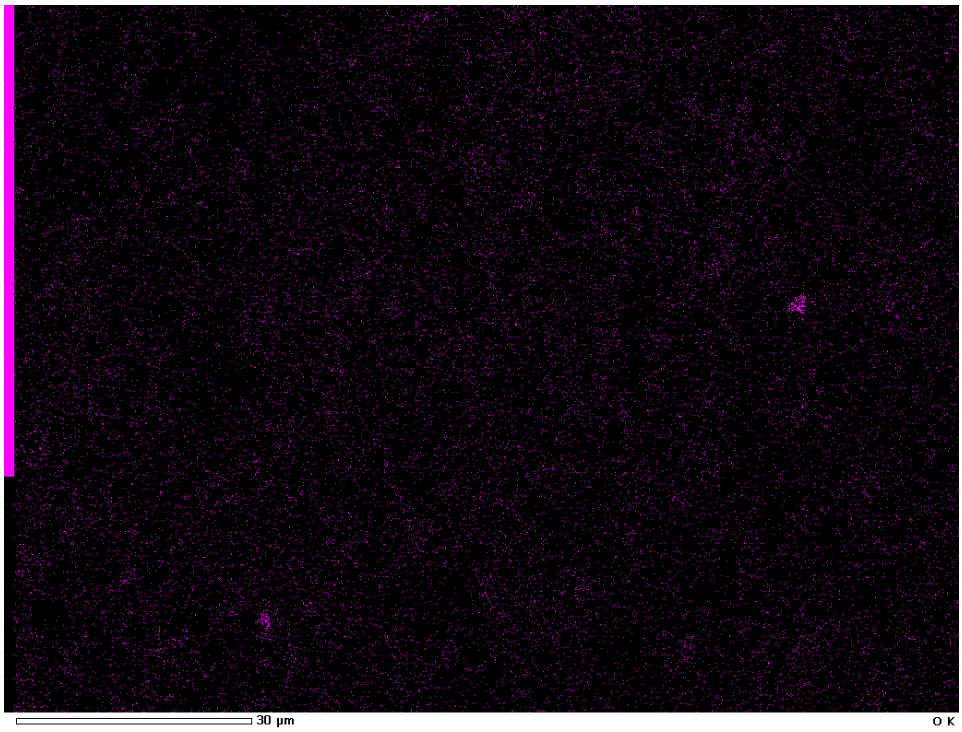
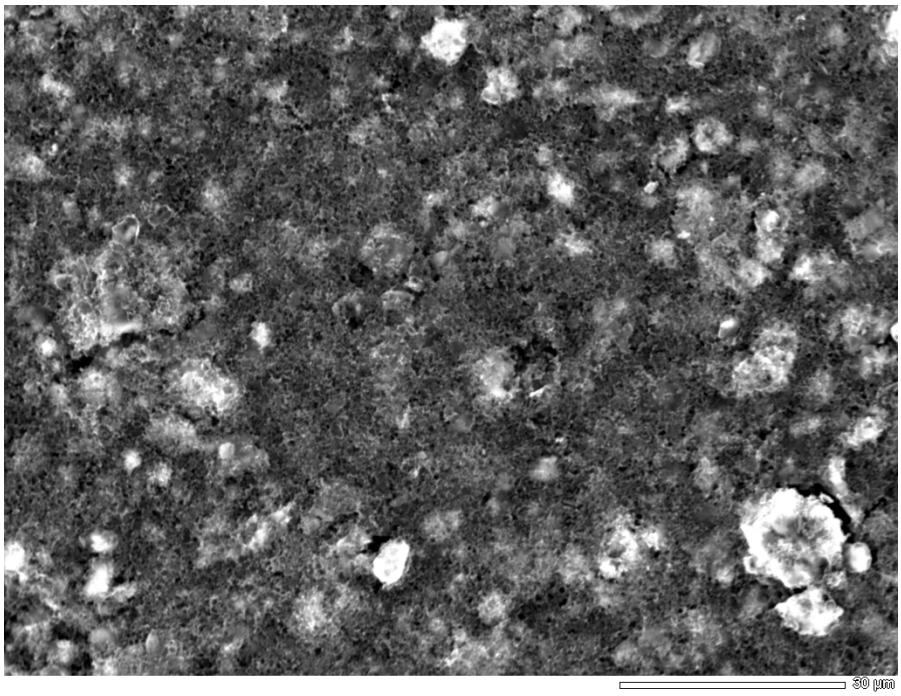
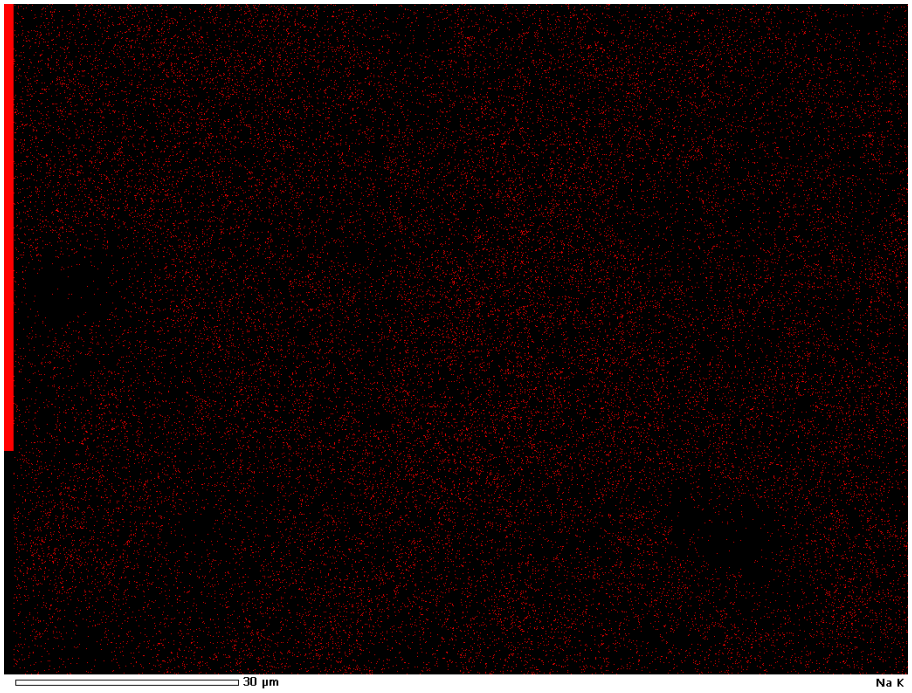


Figure S17. SEM Images of (a) CMC cathode with EDS mapping for (b) Na, (c) Cl, (d) and O.

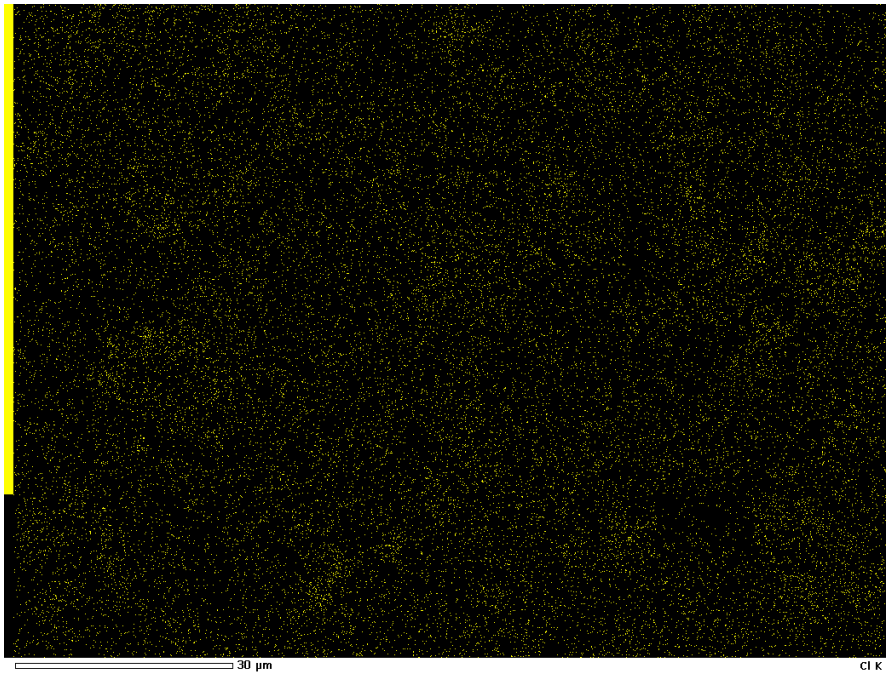
(a)



(b)



(c)



(d)