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Supporting Information

Ultra-High Initial Coulombic Efficiency of TiO_2 Anode Induced by Synergistic Role of Electrolyte and Binder for Sodium-Ion Battery

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1. Experimental section

1.1 Preparation of TiO_2 NCs CMC diglyme

For electrode (TiO_2 NCs CMC diglyme), firstly, the CMC and an appropriate amount of deionized water were put into a 25 mL weighing bottle and stirred for 6 h to completely dissolve the CMC. Then, the active material and acetylene black (Super P) were ground uniformly in a mortar, and added to the obtained CMC aqueous solution, then stirred for 12 h. The mass ratio of active materials, CMC and Super P was 70:15:15. The black slurry was coated on the copper collector with an automatic coater, then transferred to a vacuum drying oven and dried at 80 °C for 10 h. After that, the dried sample was cut into circular pieces and transferred to a glove box.

1.2 Preparation of TiO_2 NCs PVDF diglyme

For electrode (TiO_2 NCs PVDF diglyme), firstly, the PVDF and an appropriate amount of N-methyl-2-pyrrolidone were put into a 25 mL weighing bottle and stirred for 6 h to completely dissolve the PVDF. Then, the active material and acetylene black (Super P) were ground uniformly in a mortar, and added to the obtained PVDF aqueous solution, then stirred for 8 h. The mass ratio of active materials, PVDF and Super P was 80:10:10. The black slurry was coated on the copper collector with an automatic coater, then transferred to a vacuum drying oven and dried at 120 °C for 8 h. After that, the dried sample was cut into circular pieces and transferred to a glove box.

1.2 Preparation of TiO_2 NCs CMC PC

For electrode (TiO_2 NCs CMC PC), firstly, firstly, the CMC and an appropriate amount of PC were put into a 25 mL weighing bottle and stirred for 6 h to completely dissolve the CMC. Then, the active material and acetylene black (Super P) were ground uniformly in a mortar, and added to the obtained CMC aqueous solution, then stirred for 12 h. The mass ratio of active materials, CMC and Super P was 70:15:15. The black slurry was coated on the copper collector with an automatic coater, then transferred to a vacuum drying oven and dried at 80 °C for 10 h. After that, the dried sample was cut into circular pieces and transferred to a glove box.

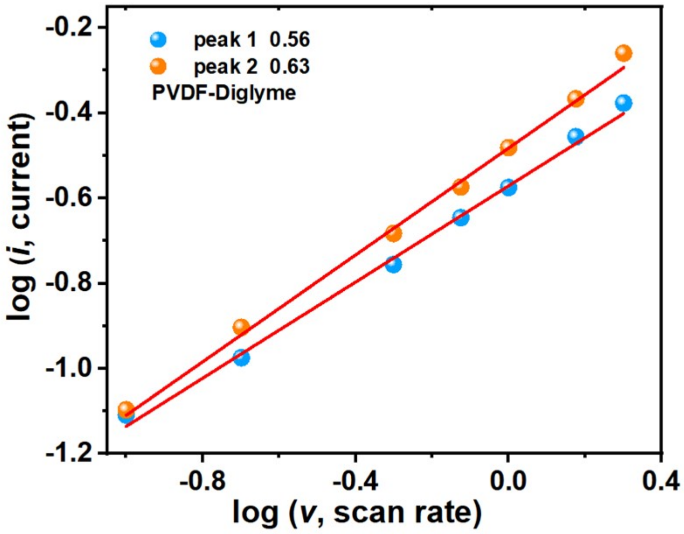

Figure. S1 b value of TiO_2 NCs PVDF diglyme.

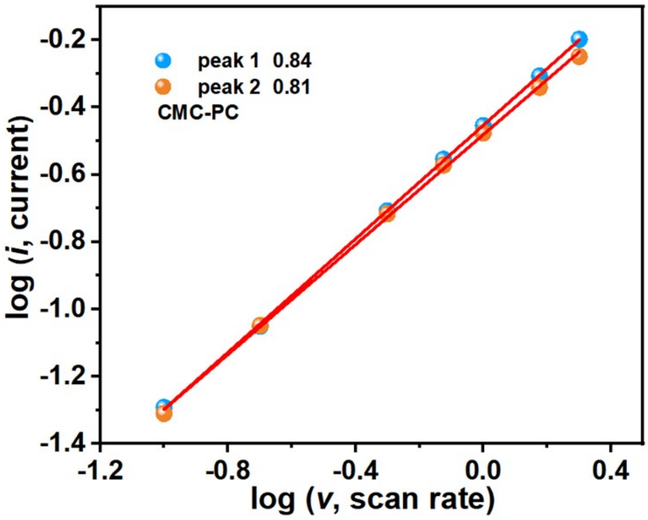

Figure. S2 b value of TiO_2 NCs CMC PC.

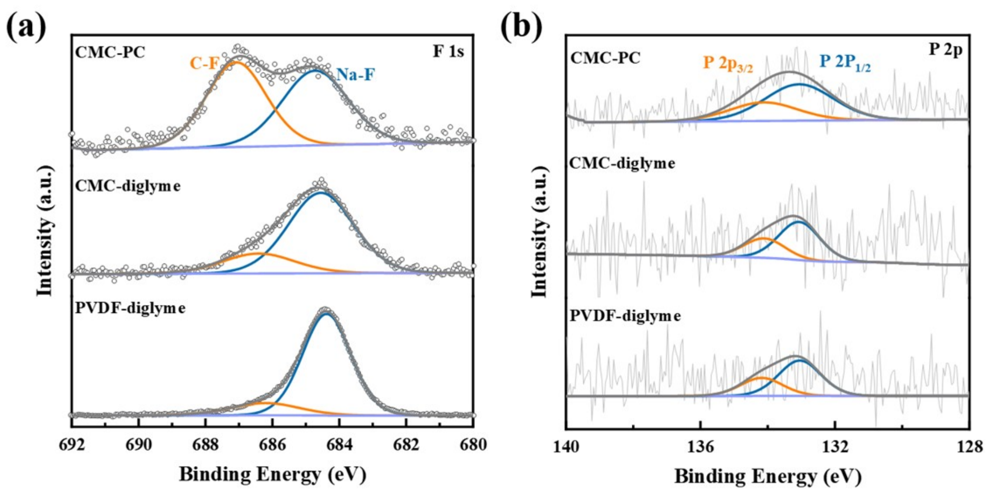

Figure. S3 Chemical characterization of SEI layers by XPS: F 1s and P 3p.

Table S1. The content of SEI layers by XPS: C 1s.

CMC-diglyme	Name	Peak BE	FWHM eV	Area (P) CPS.eV	Atomic %
C1s	C-C	284.8	0.89	28889.09	37.34
	C-H	286.35	1.71	26110.17	33.79
	C-O	288.05	1.23	11440.5	14.82
	RCH2ONa	289.78	1.62	9253.7	12
	Na2CO3	291.33	1.62	1579.1	2.05
PVDF-diglyme					
C1s	C-C	284.8	0.97	14952.25	28.43
	C-H	286.29	1.67	25230.3	48.02
	C-O	288.1	1.61	5859.75	11.17
	RCH2ONa	289.73	1.61	2959.69	5.65
	Na2CO3	290.77	1.61	3526.78	6.73
CMC-PC					
C1s	C-C	284.8	1.28	2626.62	5.31
	C-H	286.62	1.56	15607.39	31.6
	C-O	288.2	1.96	8327.24	16.88
	RCH2ONa	290.51	1.69	7366.8	14.95
	Na2CO3	291.5	1.69	15384.78	31.25

Table S2. The content of SEI layers by XPS: O 1s.

CMC-diglyme	Name	Peak BE	FWHM eV	Area (P) CPS.eV	Atomic %
O1s	Ti-O	529.2	1.38	33432.89	26.97
	C-O	530.86	1.78	55046.35	44.46
	C=O	532.41	1.62	24217.08	19.58
	Na(Auger)	535.26	2.56	11090.22	8.99
PVDF-diglyme					
O1s	Ti-O	529.23	1.3	32085.23	27.92
	C-O	530.95	1.92	49124.07	42.81
	C=O	532.35	1.92	11621.71	10.14
	Na(Auger)	536.63	2.86	21845.45	19.12
CMC-PC					
O1s	Ti-O	529.49	1.86	9494.89	4.38
	C-O	531.33	1.86	132506.58	61.17
	C=O	532.85	1.86	44834.88	20.72
	Na(Auger)	535.79	2.54	29652.52	13.74

Table S3. The content of SEI layers by XPS: F 1s.

CMC-diglyme	Name	Peak BE	FWHM eV	Area (P) CPS.eV	Atomic %
F1s	Na-F	684.55	2.31	13865.38	78.42
	C-F	686.41	2.56	3808.65	21.58
PVDF-diglyme					
F1s	Na-F	684.38	1.7	71677.22	85.41
	C-F	686.2	2.4	12219.06	14.59
CMC-PC					
F1s	Na-F	684.72	2.33	7944.46	49.17
	C-F	687.08	2.12	8195.96	50.83

Table S4. The content of SEI layers by XPS: P 3p.

CMC-diglyme	Name	Peak BE	FWHM eV	Area (P) CPS.eV	Atomic %
P2p	P2p3 Scan A	133.06	1.44	147.4	100
	P2p1 Scan A	134.11	1.44	75.29	0
PVDF-diglyme					
P2p	P2p1/2	133.05	1.48	216.71	100
	P2p3/2	134.18	1.48	110.69	0
CMC-PC					
P2p	P2p3 Scan A	133.07	2.4	433.07	100
	P2p1 Scan A	134.12	2.4	221.2	0