Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

High Performance Lithium Storage in Ultrafine Manganese Fluoride Nanorod Anode with Enhanced Electrochemical Activation Process Based on Conversion Reaction†

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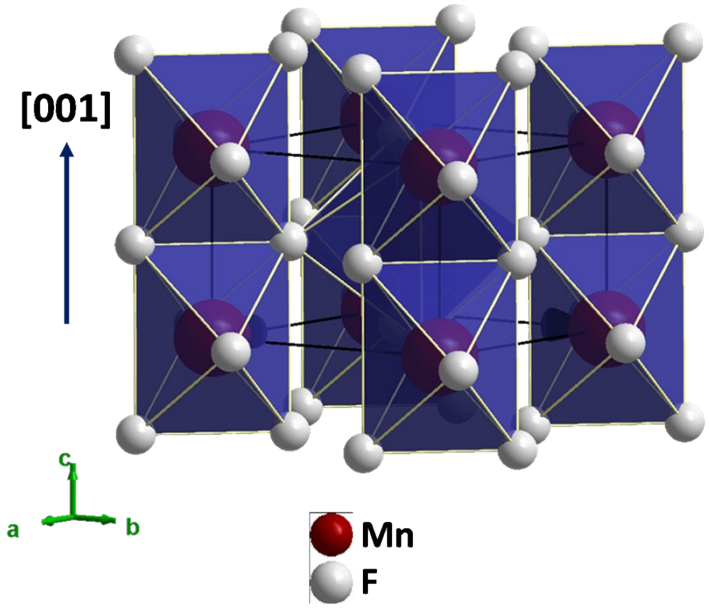

Fig. S1 The crystal structure of tetragonal MnF_2 (P42/mnm) classed to Rutile group.

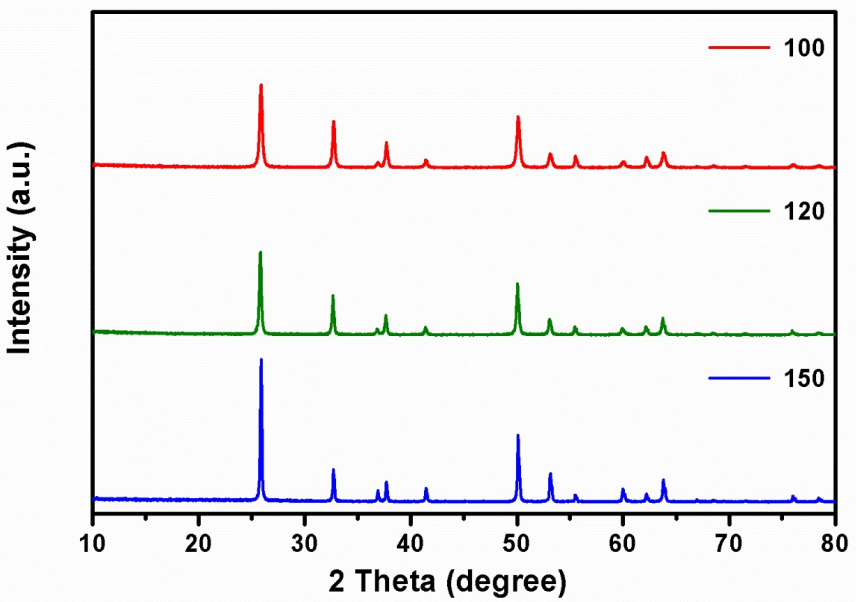

Fig. S2 XRD patterns of the samples that were prepared for 24h at different solvothermal temperatures.

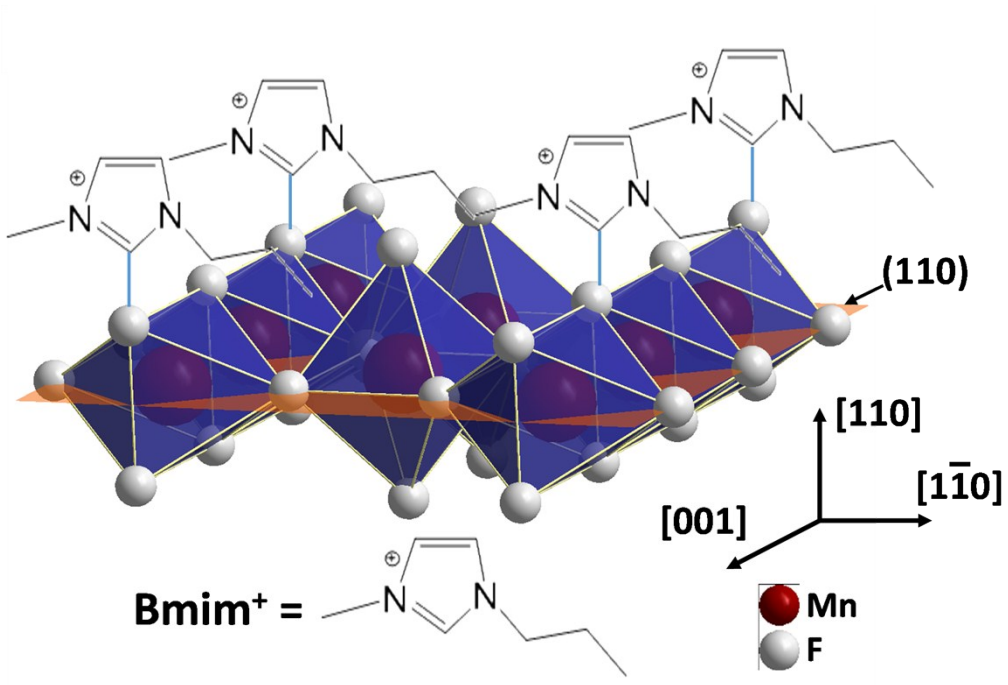

Fig. S3 Schematic illustration of a projected view of [Bmim]$^+$ ions anchored onto (110) plane to form tight coverage layer via the original cell.

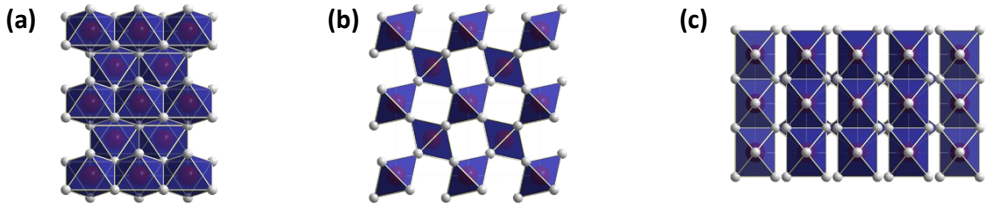

Fig. S4 Schematic illustration of MnF_6 octahedron in different projection directions (a) [100], (b) [001], (c) [110]

The atom F density of different planes can be calculated as follows.

(a) (100)

$$\frac{0}{a * c}$$

(b) (001)

$$\frac{2}{a * a} = \frac{2}{4.8736 * 4.8736} = \frac{2}{23.75}$$

(c) (110)

$$\frac{2}{\sqrt{2} * a * c} = \frac{2}{1.414 * 4.8736 * 3.3020} = \frac{2}{22.75}$$

Table S1. Impedance parameters of as-prepared nanorod MnF_2 anode at specified cycles together with the control sample obtained at 150 ºC

Electrodes	R_e/ Ω	R_{SEI}/ Ω	R_{ct}/ Ω
50^{th} -150	2.83	-	52.3
OCV-100	2.88	-	46.6
1^{st} -100	3.39	11.4	27.5
50^{th} -100	2.77	9.07	23.5
100^{th} -100	2.99	7.48	20.3

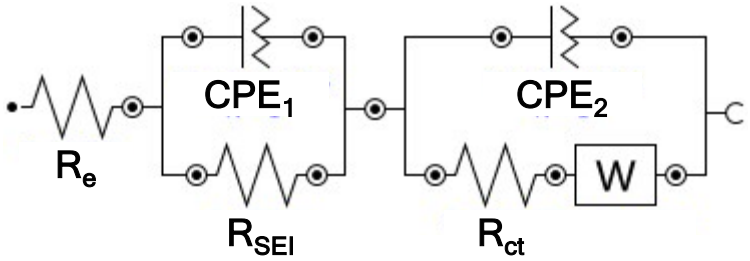

Fig. S5 The simplified equivalent circuit used for impedance fitting.

Table S2. Comparison of the electrochemical performance of MnF_2 nanorod anode in this work with those of metal fluorides of similar morphology reported in the literatures

Samples	Theoretical capacity / mAh g^{-1}	Current density	Initial capacity / mAh g^{-1}	Capacity after cycling / mAh g^{-1}	REF
FeF_2@C nanorods	571 for FeF_2	30 mA g^{-1}	314	217 (50 cycles)	S1
		100 mA g^{-1}	ca.200	-	
		200 mA g^{-1}	ca.160	-	
		500 mA g^{-1}	ca.100	-	
Carbon-Nanotube-Encapsulated FeF_2 nanorods	571 for FeF_2	50 mA g^{-1}	352	263 (50 cycles)	S2
		100 mA g^{-1}	-	181 (50 cycles)	
		500 mA g^{-1}	-	124 (50 cycles)	
		1 A g^{-1}	-	92 (50 cycles)	
FeF_3 nanowires	712 for FeF_3	50 mA g^{-1}	543	223 (50 cycles)	S3
		200 mA g^{-1}	ca.470	157 (50 cycles)	
MnF_2 nanorod	577	0.1 C	450 (reversible)	560 (50 cycles)	This work
		1 C (577 mA g^{-1})	415	540 (100 cycles)	
		2 C	380	410 (100 cycles)	
		5 C	300	273 (100 cycles)	
		10 C	215	430 (2000 cycles)	

1. Y. L. Zhang, L. Wang, J. J. Li, L. Wen and X. M. He, *Journal of Alloys and Compounds*, 2014, **606**, 226-230.
2. J. Zhou, D. Zhang, X. Zhang, H. Song and X. Chen, *ACS Appl. Mater. Interfaces*, 2014, **6**, 21223-21229.
3. L. Li, F. Meng and S. Jin, *Nano Lett.*, 2012, **12**, 6030-6037.