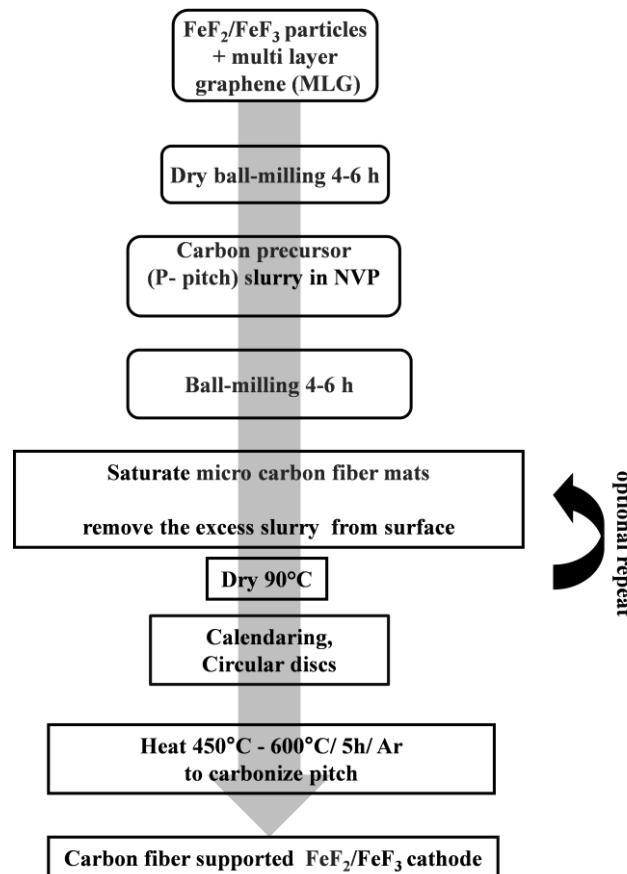


## Electrode Architectures for High Capacity Multivalent Conversion Compounds: Iron (II and III) Fluoride

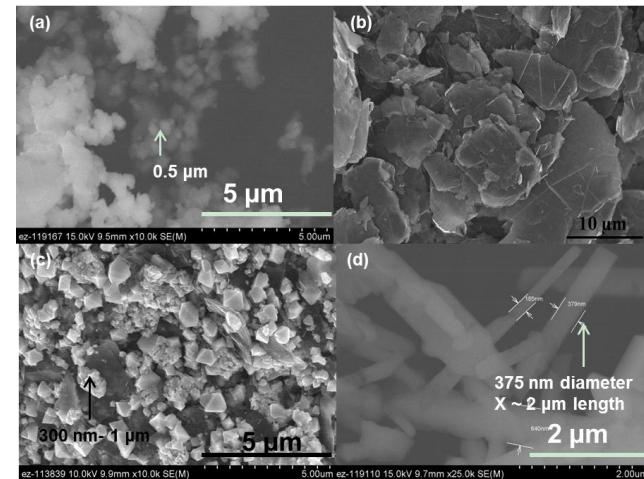
Surendra K. Martha, Jagjit Nanda, Hui Zhou, Juan C. Idrobo, Nancy J. Dudney, Sreekanth Pannala, Sheng Dai, Junjie Wang, Paul. V. Braun

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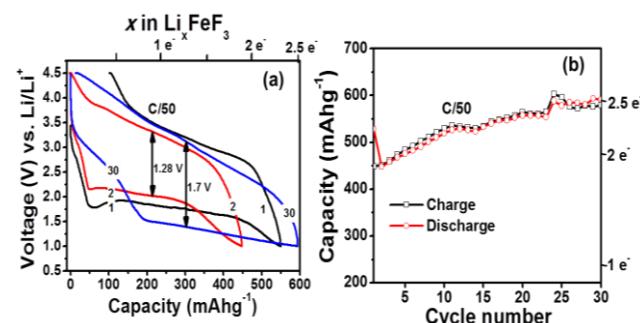
### Supplementary figures and tables



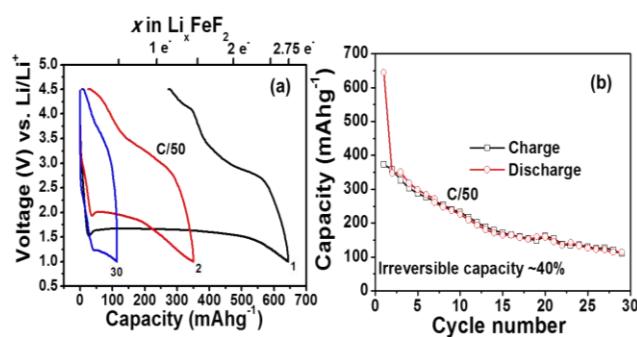
10 **Figure S1.** Schematics of electrode fabrication process for Iron (II) and (III) fluoride cathodes



15 **Figure S2.** SEM images showing typical shapes and sizes of FeF<sub>2</sub> and FeF<sub>3</sub> particles and electrodes (a) Pristine FeF<sub>3</sub> powder (as received), (b) pristine MLG, (c) pristine FeF<sub>3</sub>-after electrode fabrication at 600°C, (d) Pristine FeF<sub>2</sub> powder (as received).



20 **Figure S3.** (a) Voltage vs. capacity profiles of a Li/FeF<sub>3</sub> cell (on carbon fiber) cycled between 1.0 V and 4.5 V (C/50 rate) at 25°C. (b) Capacity plotted as a function of cycle number for the Li/FeF<sub>3</sub> cell.

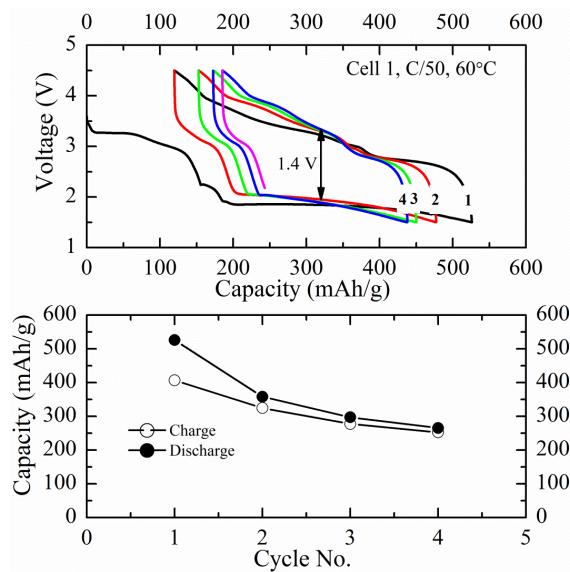


**Figure S4.** (a) Voltage vs. capacity profiles of a Li/FeF<sub>2</sub> cell (on Al-foil) cycled between 1.0 V and 4.5 V (C/50 rate) at 25°C. (b) Capacity plotted as a function of cycle number for the Li/FeF<sub>2</sub> cell. Electrode Composition: FeF<sub>2</sub> (50%), Graphene (40%), PVDF (10%) on Al foil.

Parameters	1.5 V-4.5V at 25°C	1.0 V-4.5V at 25°C	1.5 V-4.5V at 60°C	2.3 V-4.5V at 25°C	2.3 V-4.5V at 60°C (1.5V cut off)
Irreversible capacity loss (ICL) (%)	7.5	14.5	~25		
1 <sup>st</sup> cycle lithiation capacity (mAh/g)	465	528	685	35 (1.5V)	175
Highest reversible capacity (mAh/g)	445 (~2 e <sup>-1</sup> )	595 (2.5 e <sup>-1</sup> )	692 (~3 e <sup>-1</sup> )	150 (1.5V) 192 (1.0V)	235 (1 e <sup>-1</sup> )
Hysteresis (V)	0.9-1.0	1.3 (2 <sup>nd</sup> cycle) 1.7 (30 <sup>th</sup> cycle)	0.8	0.4 (1.5V) 1.5 (1.0V)	0.35
Specific Energy (Wh kg <sup>-1</sup> )	990-1010	1060	1650	460 (1.5V) 535 (1.0V)	740

**Table S1:** Irreversible capacity loss, 1<sup>st</sup> lithiation capacity, reversible capacity, hysteresis and specific energy of FeF<sub>3</sub> at various cut-off voltages and temperatures.

<sup>10</sup> The electrochemical performance at 60 °C for the slurry coated FeF<sub>3</sub> electrode is shown below in figure S5.



**Figure S5** 60 °C cycling performance of the FeF<sub>3</sub> slurry coated electrode on Al current collector.