Synthesis of Nanocrystalline Iron(III) trifluoride from Molecular Precursors and its Li- and Na-ion Storage Properties

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The performance demands placed on batteries for the use in electrical mobility and portable devices are enormous. Cathode materials remain a bottleneck for the further increase on energy density. A promising candidate compound featuring low cost and high natural abundance is iron trifluoride (FeF_3). It has been demonstrated that FeF_3 intercalates lithium with near theoretical capacity of 237 mAh/g [1], also with promising rate capability [2]. However, there remains a strong need to develop low-cost synthesis methods for this material in a nanoscale form, needed for maximizing the performance. Herein, we show a new synthesis for nanocrystalline FeF_3 based on a thermal decomposition of an organic precursor. Such inexpensive FeF_3 can be charged and discharged in a lithium half-cell at a reversible capacity of 155 mAh/g within 1 min (10 A/g) or even faster. After 100 cycles, a capacity retention of 88 % has been achieved. In a sodium-ion half-cell, a capacity of 160 mAh/g at a current rate of 0.2 A/g could be measured. [3]

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