Preparation of Nanoporous $FeF_3 \cdot 3H_2O$ as Cathode Materials for Rechargeable Lithium-Ion Batteries

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Metal fluorides have been widely investigated due to their using as next-generation cathode materials for LIBs in the last years [1].

We have preparated hydrated iron trifluoride using the following reagents: an aqueous solution of $Fe(NO_3)_3$ $9H_2O$, ammonia (25%) and HF (40%). Iron nitrate mixed with ammonia water and washed by distilled water to neutral pH. Next, excessive HF solution was added to the above precipitates and put into a stainless steel autoclave, which was kept at 70 ^{0}C for 9 hours. The precipitate was dried at 80 ^{0}C for 12 hours at oven in Ar atmosphere.

As a result, according to the X-ray analysis and Mössbauer spectroscopy was obtained β-$FeF_3 \cdot 3H_2O$ phase (PDF: 32-0464) with an average size of coherent scattering regions to 40 nm.

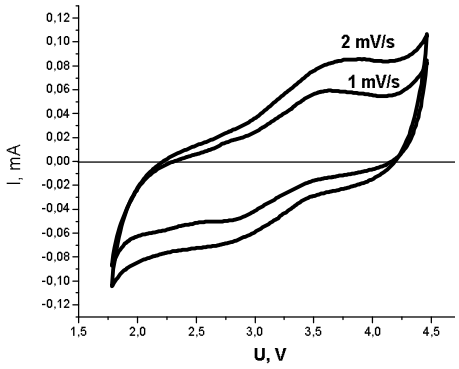

Fig.1. CV curves of β-$FeF_3 \cdot 3H_2O$ at the scan rate 1 and 2 mV/s

Cyclic voltammetry (CV) tests were performed to assess the possibility of using the material in LIBs reversible.

The cathodes for testing cells were fabricated by mixing the cathode material, carbon black, and polyvinylidene fluoride with a weight ratio of 75:15:10, respectively.

CV curves obtained in the range of 1.8-4.5 V at the scan rate 1 and 2 mV/s. Our material shows a pairs oxidation-reduction peaks at ≈ 3.6 V and ≈ 2.8 V, which correspond to intercalation and deintercalation of lithium ions into the material structure. The capacity retention reach up to 90%.

1. Q. Chu, Z. Xing, J. Tian, X. Ren, Abdullah M. Asiri, Abdulrahman O. Al-Youbi, Khalid Ahmad Alamry, X. Sun J. Power Sources 236 (2013) 188 – 191.