Reduced form of Prussian Blue (Prussian white) cathode material for application in two electrode systems

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With an increasing annual demand for energy storage devices there is a progressive attention on the research for rechargeable batteries. Even though traditional lithium-ion batteries offer great performance, they are unable to satisfy huge consumption worldwide, since the limits on availability of lithium resources. Sodium-ion batteries can be potential substitute for LIBs owing cost-effectivity and abundance of sodium salts.

Since cathode material of a battery has a great impact on the final performance of the battery, more and more researches are progressively focused on optimizing their properties to enable them for practical use. One of the promising cathode materials are representatives of Prussian Blue analogues, owing to their high energy density, wide range of working potentials and chemical and electrochemical stability. Their common representative – $Na_2FeFe(CN)_6$ offers good discharge capacity and long cycling life, owing two RedOx reaction with both iron atoms (Fe^{2+}↔$Fe3^{+}$). However during traditional synthesis methods – straightforward precipitation, the product always comes in half-charged (half-oxidized) state – $NaFe^{III}Fe^{II}(CN)_6$ due to its ease of oxidation of outer iron ion (for example by air oxygen). It is cause for only half of full capacity during 1st charge and does not seem to be a problem for three-electrode systems, where counter electrode has capacity in a huge excess. However, for two-electrode systems, where working and counter electrodes are ought to be balanced (at first cycle) in terms of loading mass and capacities, it is a problem.

Herein, the synthesis of PBA with reduced form (Prussian white) is presented and compared electrochemically with precipitation synthesis method.

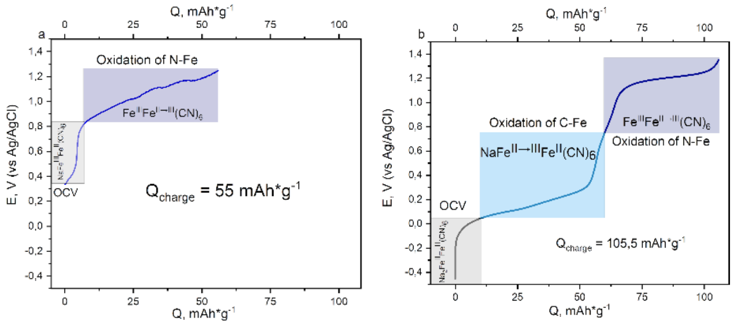

Figure 1 – First charges of PB materials synthesized by different methods

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