

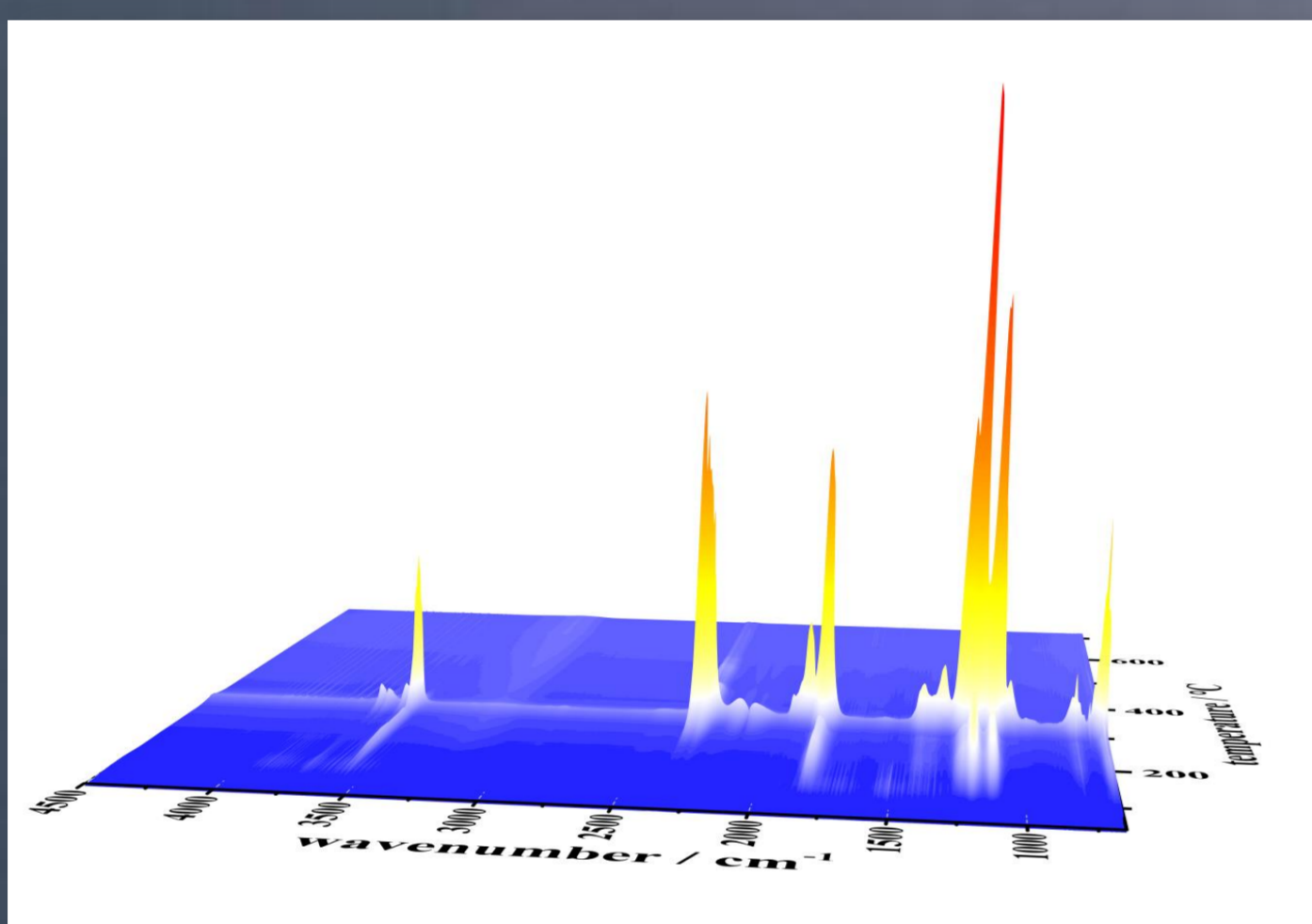
Sol-gel based synthesis of quaternary lithium transition metal fluorides and their characterization as cathode-materials

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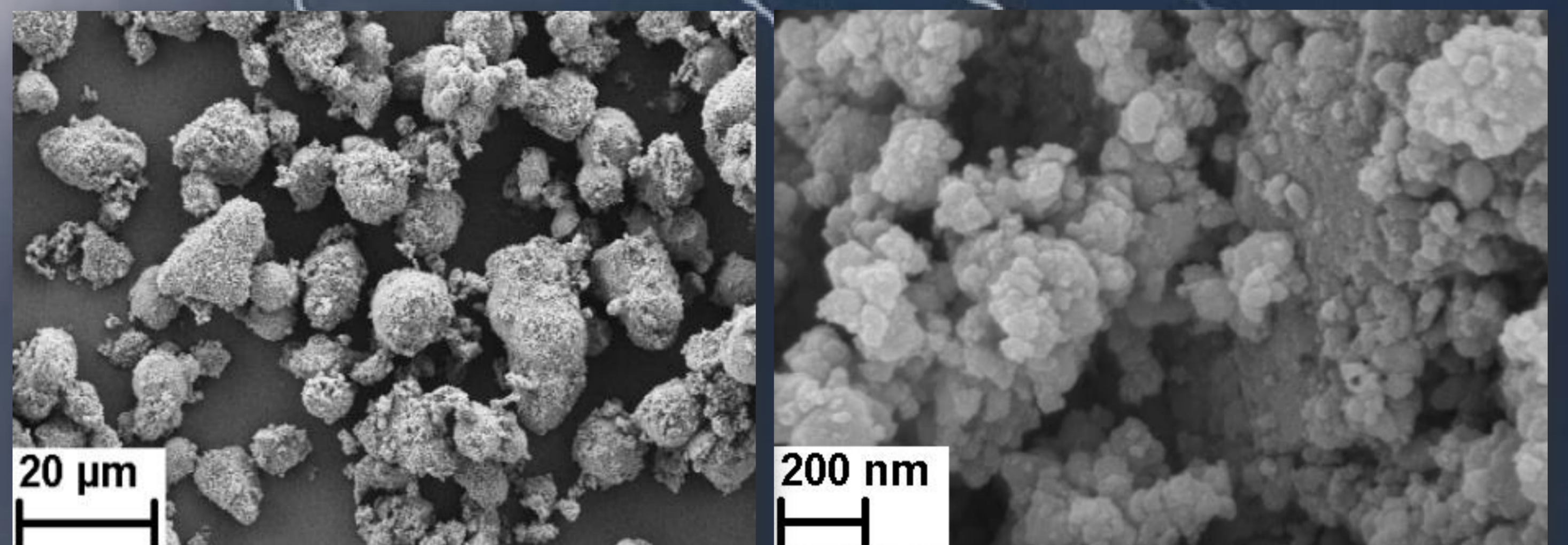
Introduction:

Lithium transition metal oxides are commonly used as cathode materials in modern mobile and stationary power supplies. Lithium transition metal fluorides represent an interesting new class of materials for lithium ion batteries featuring a higher voltage due to the substitution of oxygen by the more electronegative fluorine. A sol-gel based process with trifluoroacetic acid as fluorine source was used to synthesize $\text{LiMe}^1\text{Me}^2\text{F}_6$. Further processing was needed to characterize the first electrochemical performance of a quaternary lithium transition metal fluoride, containing two different transition metals. Cycle stability tests over 20 cycles and performance rate tests up to 1C were conducted with a full reversible capacity. The redox reaction involving $\text{Fe}^{3+}/\text{Fe}^{2+}$ during Li insertion/deinsertion can be confirmed by Mössbauer spectroscopy and cyclic voltammetry.

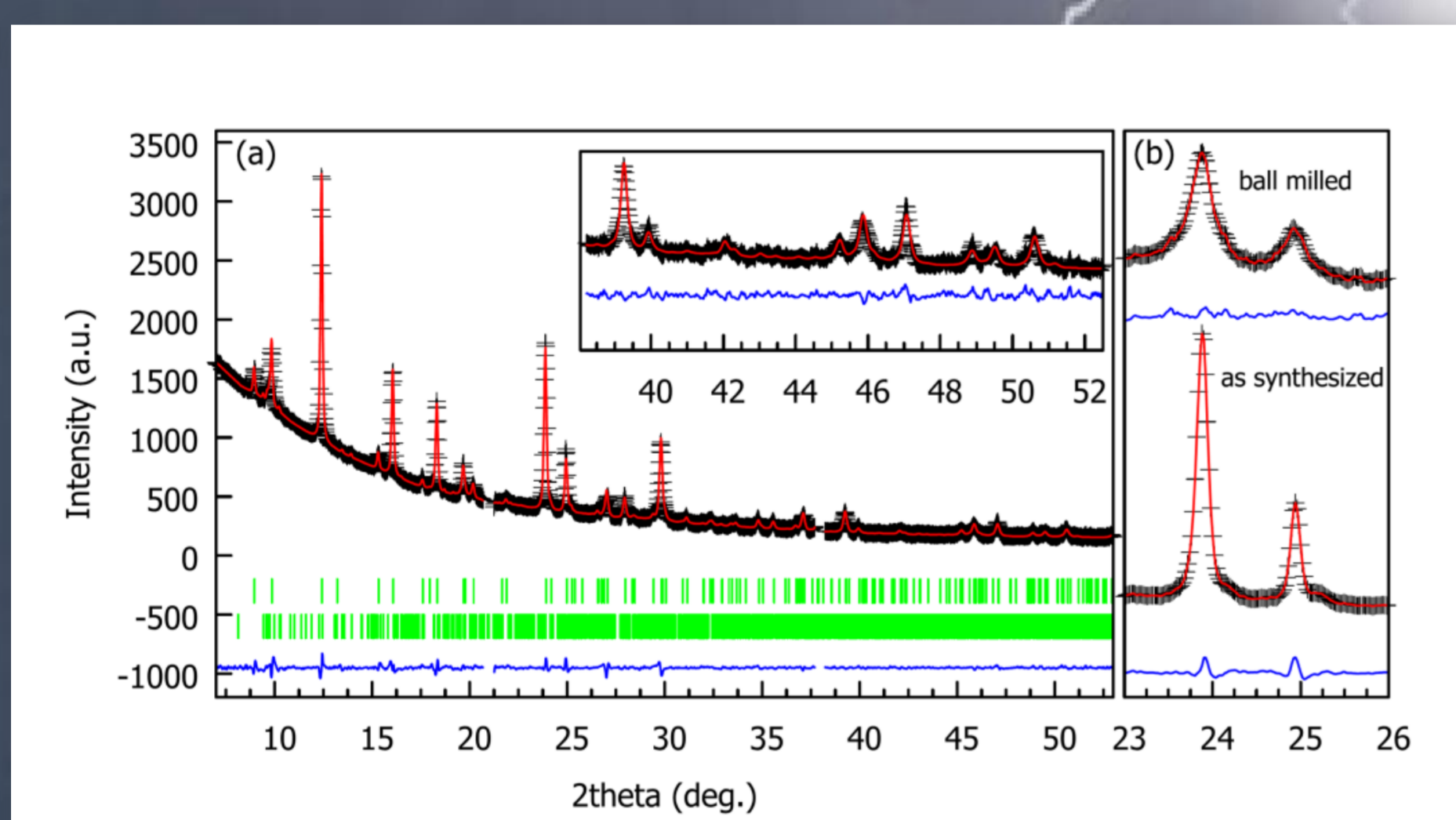
TG-FTIR



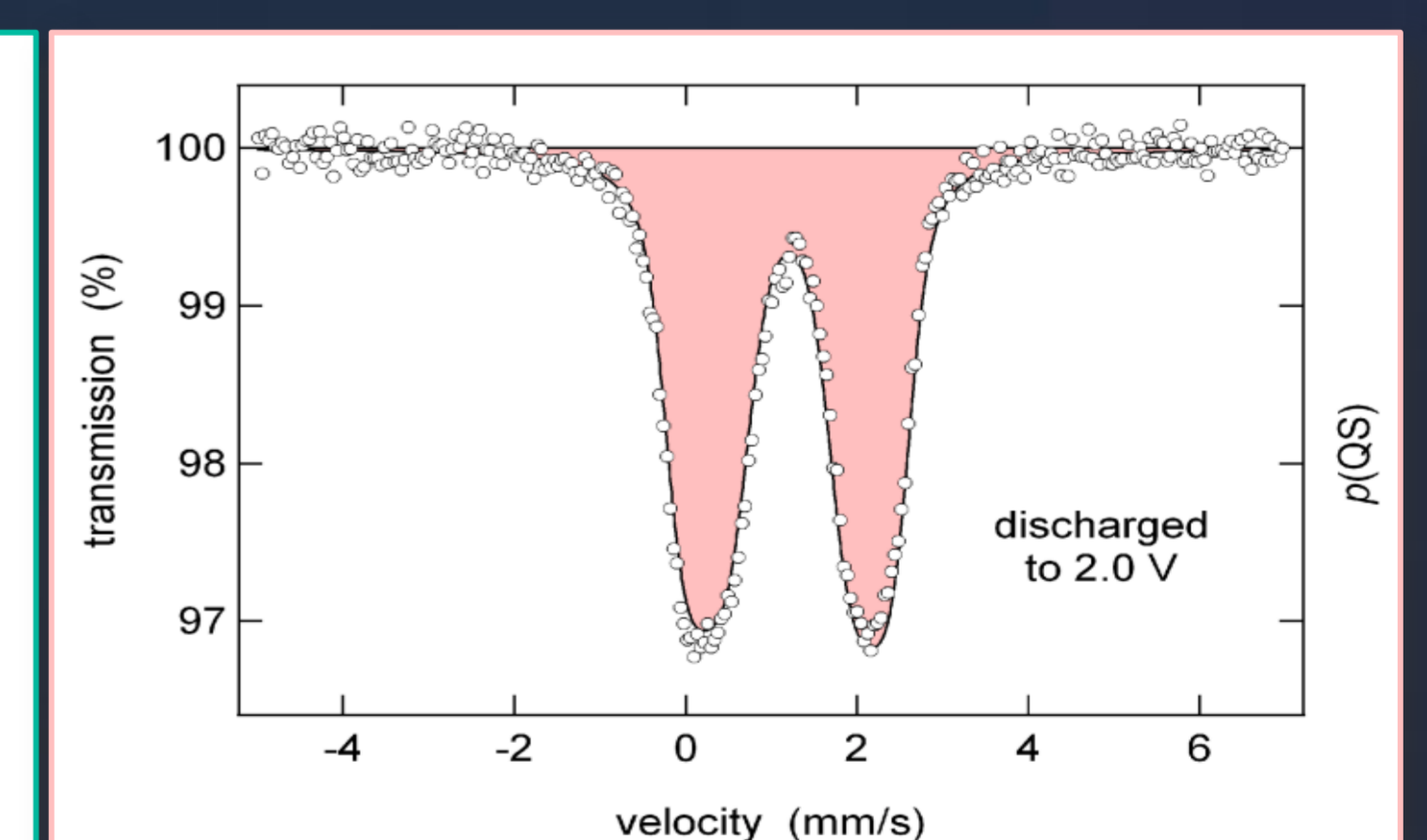
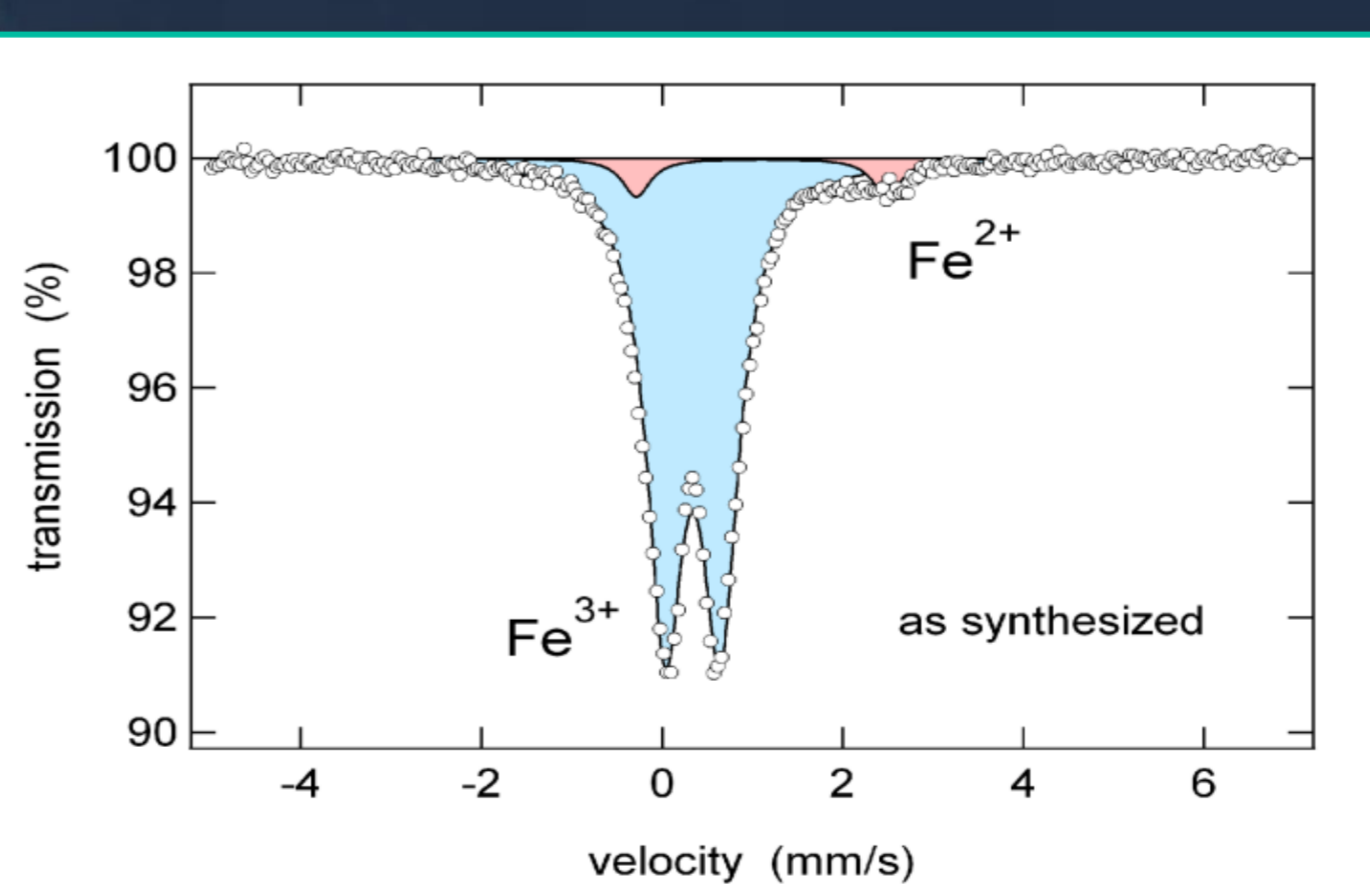
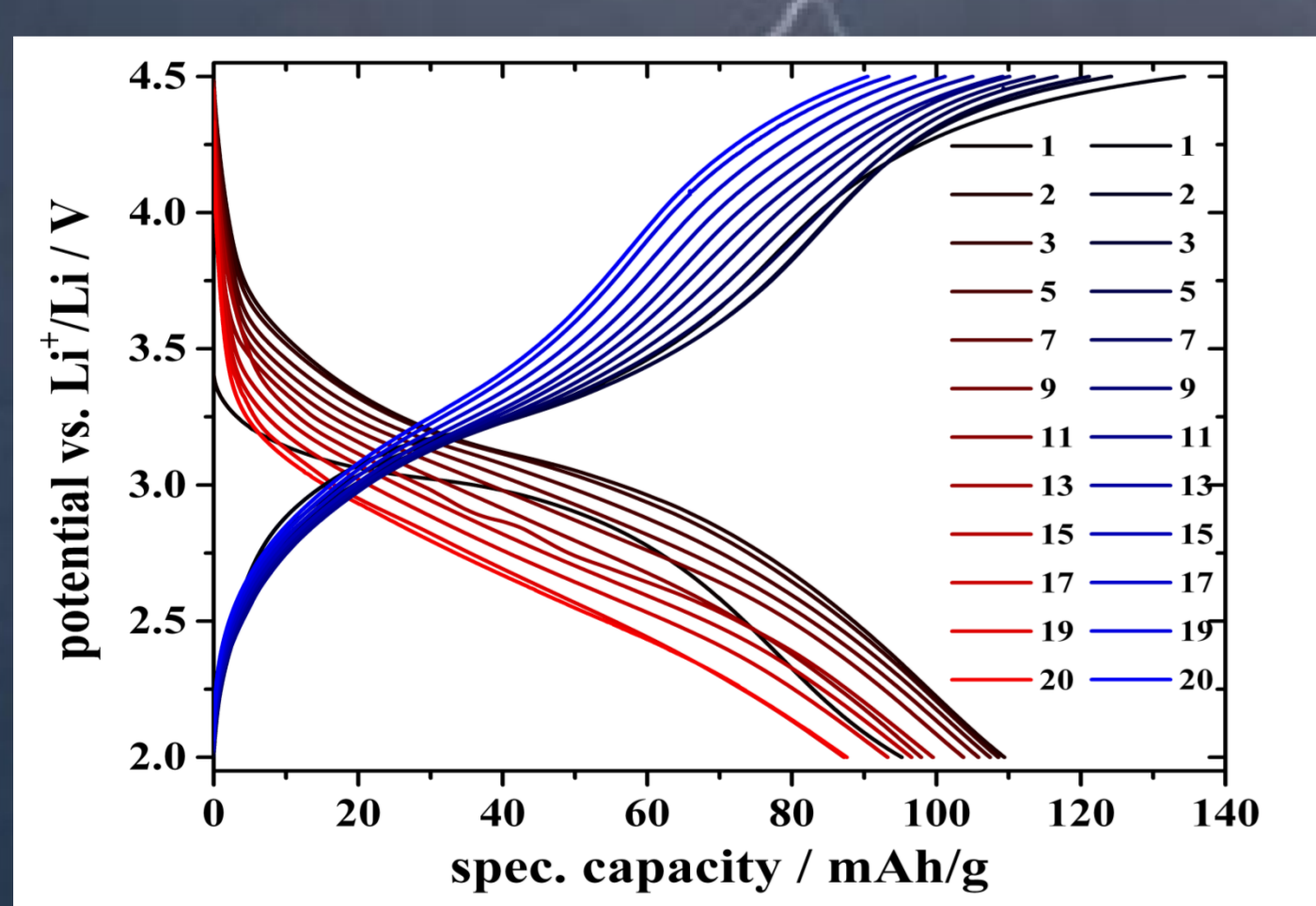
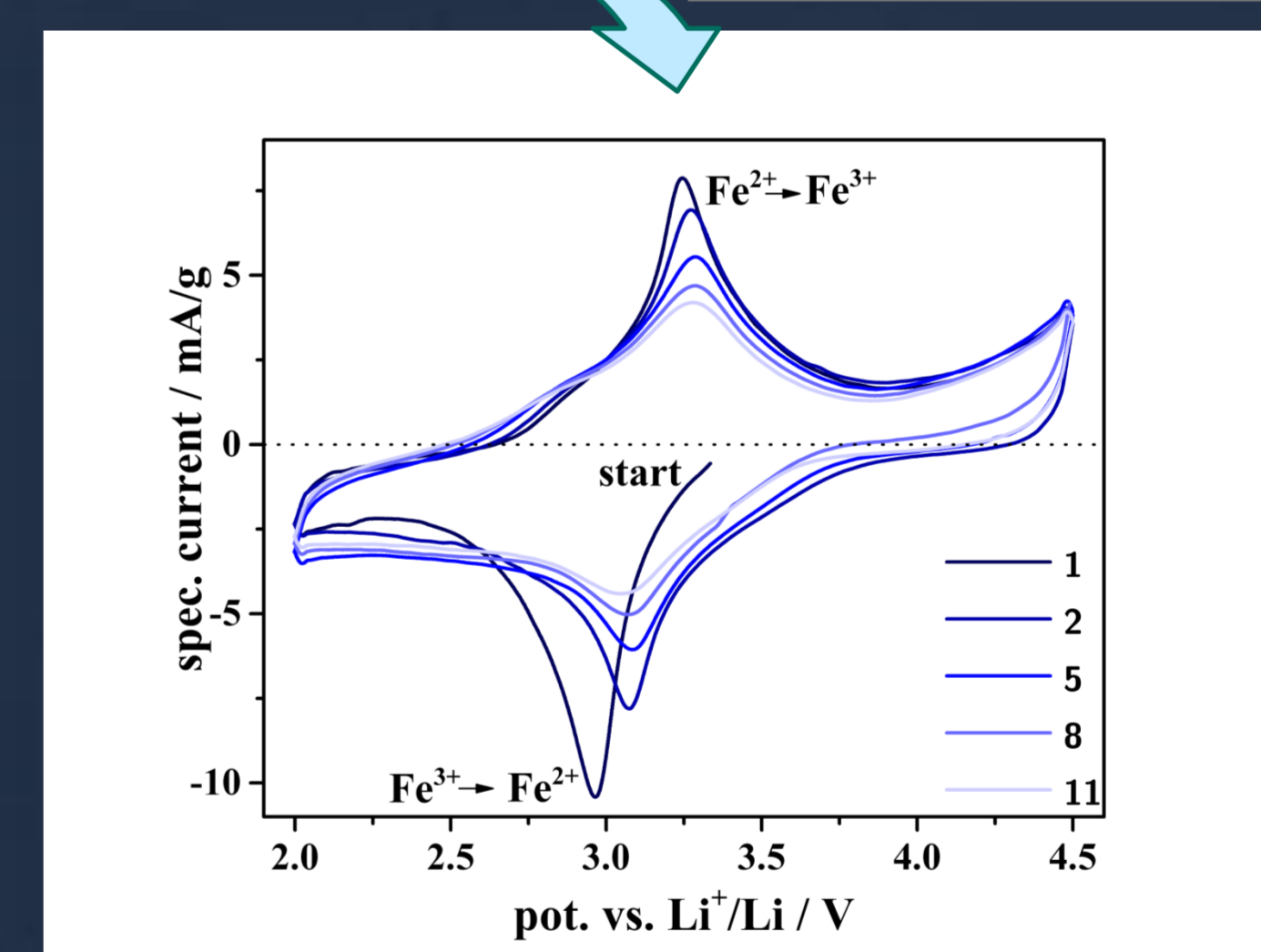
Morphology



Struct. characterization



Cyclic voltammetry



What has to be done:

1. Formation of sol-gel with TFA and metal acetates
2. Spary drying (120°C)
3. Pyrolization of the precursor powder at low temperatures (450°C)
4. Dry ball-milling with carbon and binder resulting in a $\text{LiMe}^1\text{Me}^2\text{F}_6$ /carbon/binder nanocomposite
5. Apply composite on a thin Al-foil to gain a thin cathode
6. Electrochemical characterization in a 2-electrode Swagelok-cell against lithium