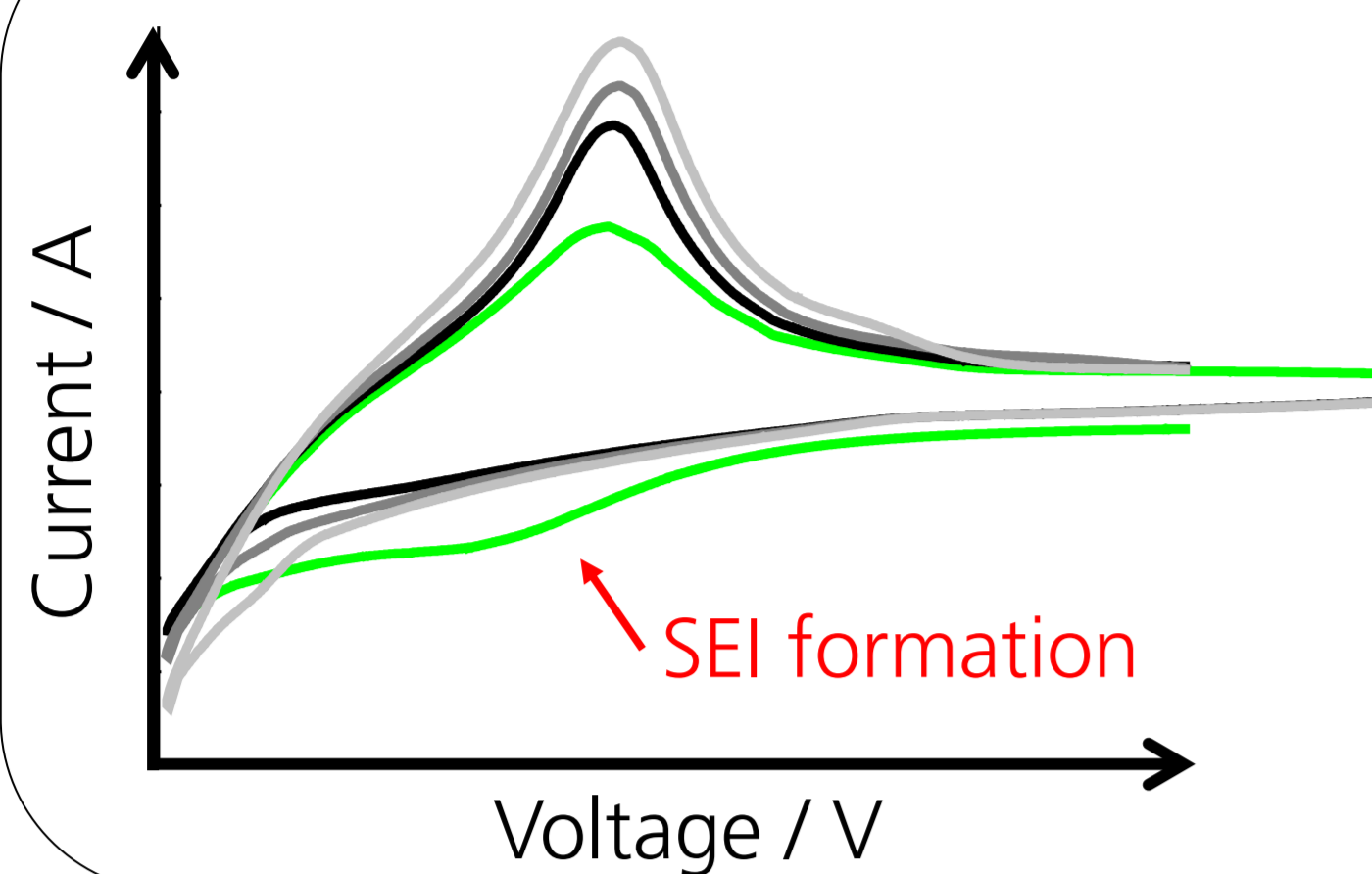
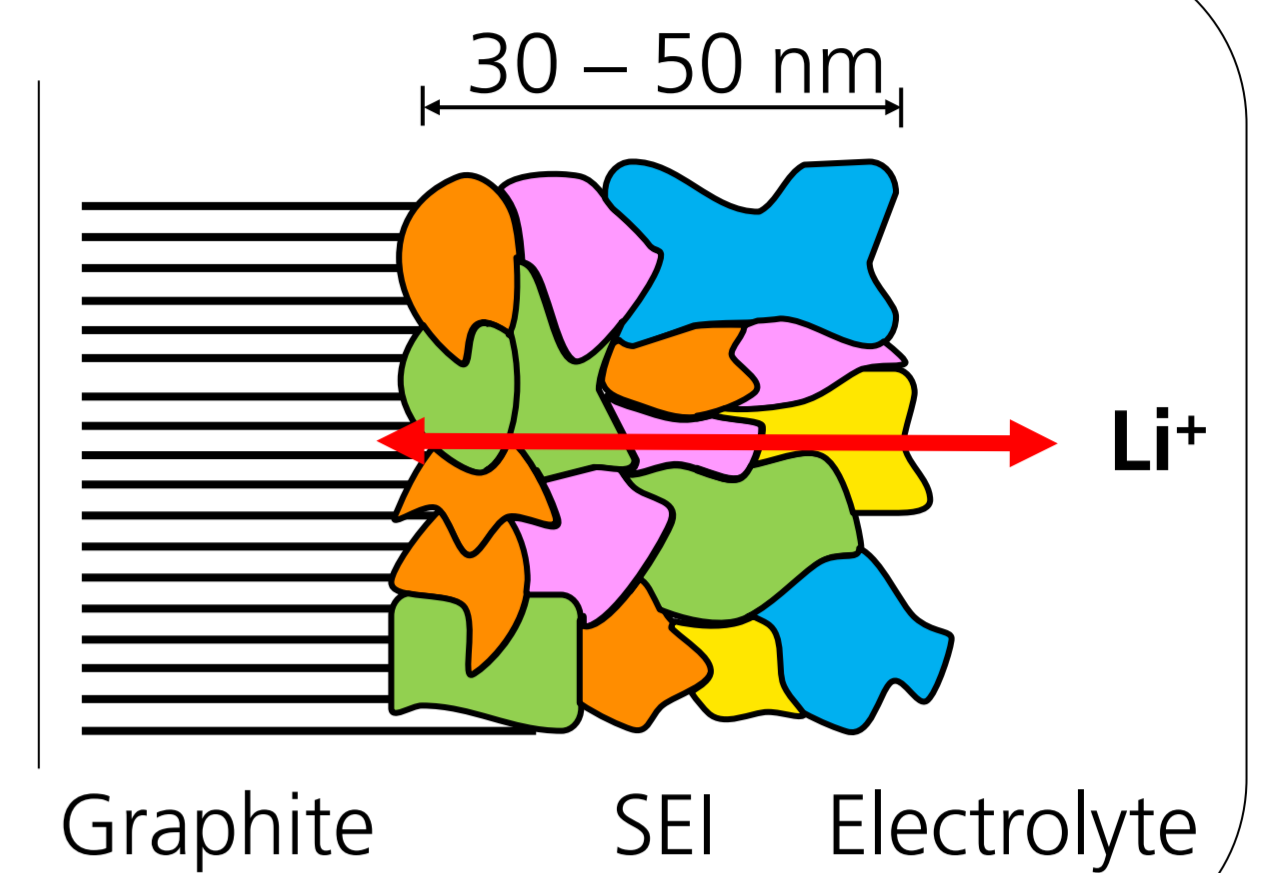


Introduction

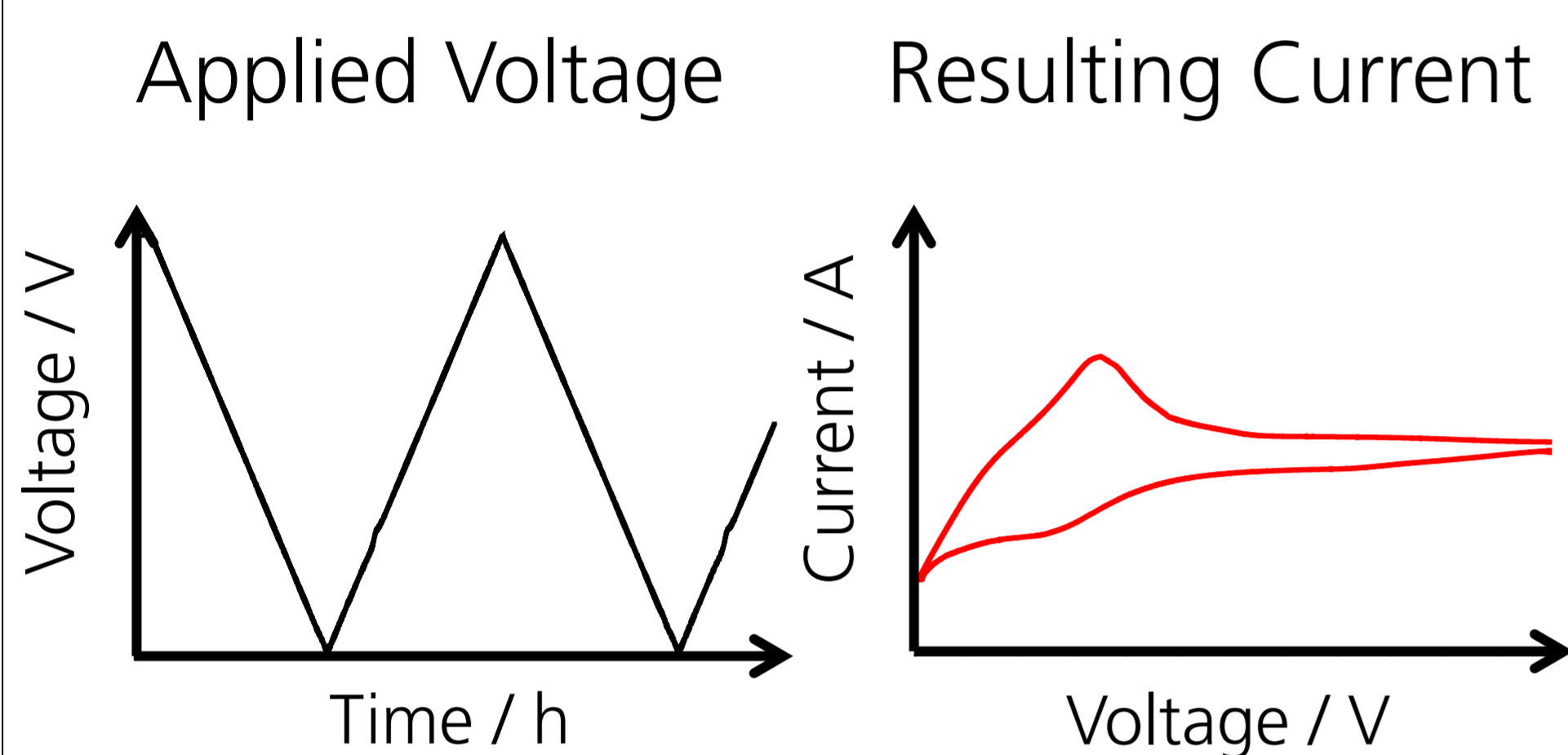


During the first cycles of a lithium-ion battery a solid film forms on the anode side. It mainly consists of decomposition products of the electrolyte and is therefore called Solid Electrolyte Interphase (SEI). The SEI is crucial for the cycle-life of the battery as it prevents destruction of the anode by co-intercalation. Nonetheless it also has negative aspects as it invariably produces irreversible capacity loss.



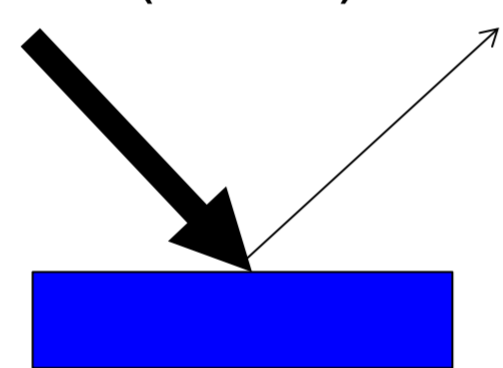
Principle of Application

Cyclovoltammetry (CV)



- Triangular voltage is applied
- Resulting current curve reveals information about electrode processes

Fourier Transform Infrared Spectroscopy (FTIR)



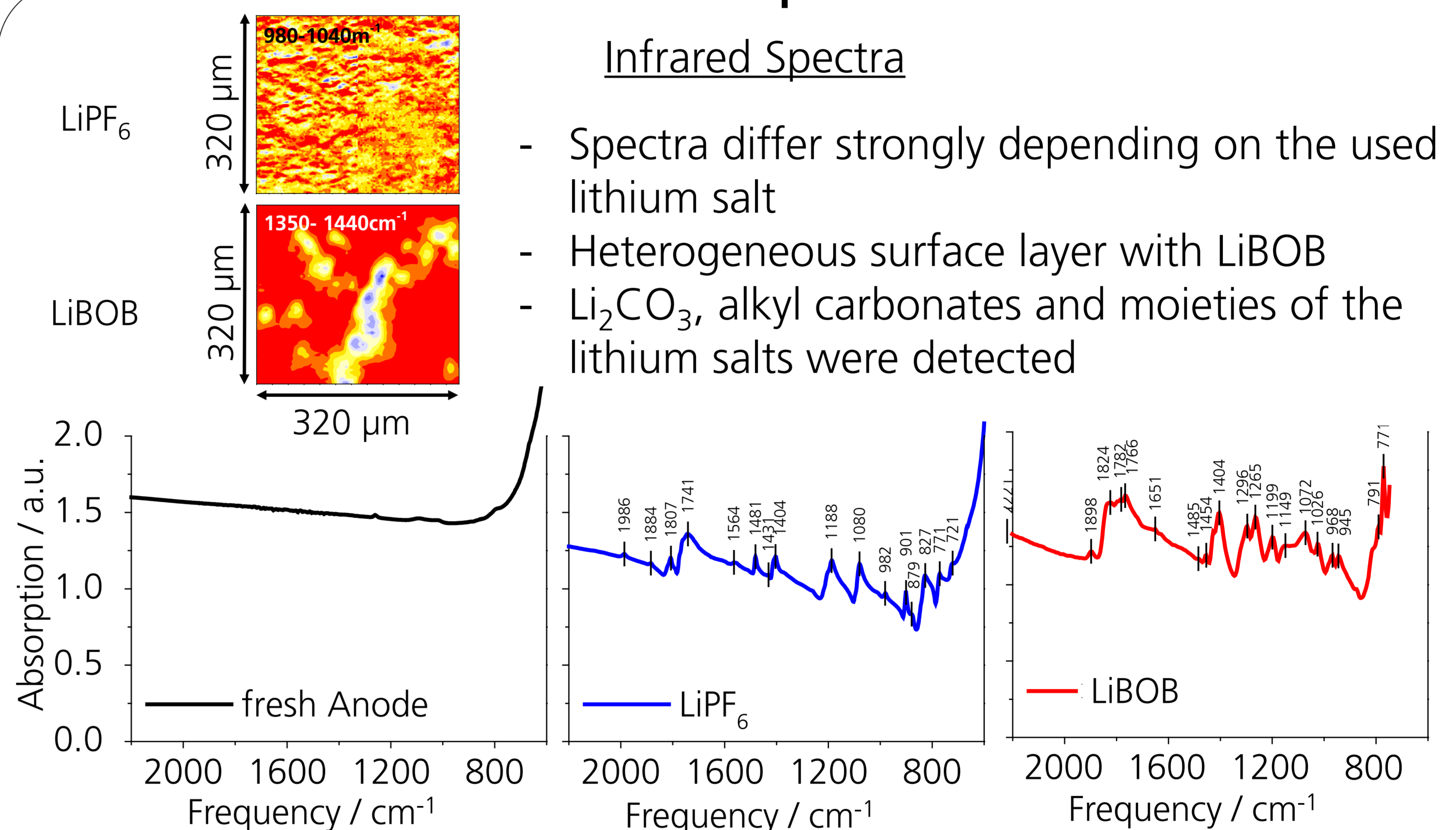
- Disassembled anode was dried for 2 h
- FTIR measurement was performed in reflexion mode
- FTIR mapping was used to investigate homogeneity

Used Materials

- Graphite vs. Li/Li⁺
- Organic solvent: EC:DEC 3:7 wt.-%
- Lithium salt: 1 M lithium bis(oxalato) borate (LiBOB) or 1 M lithium hexa-fluorophosphate (LiPF₆)

Experimental Results

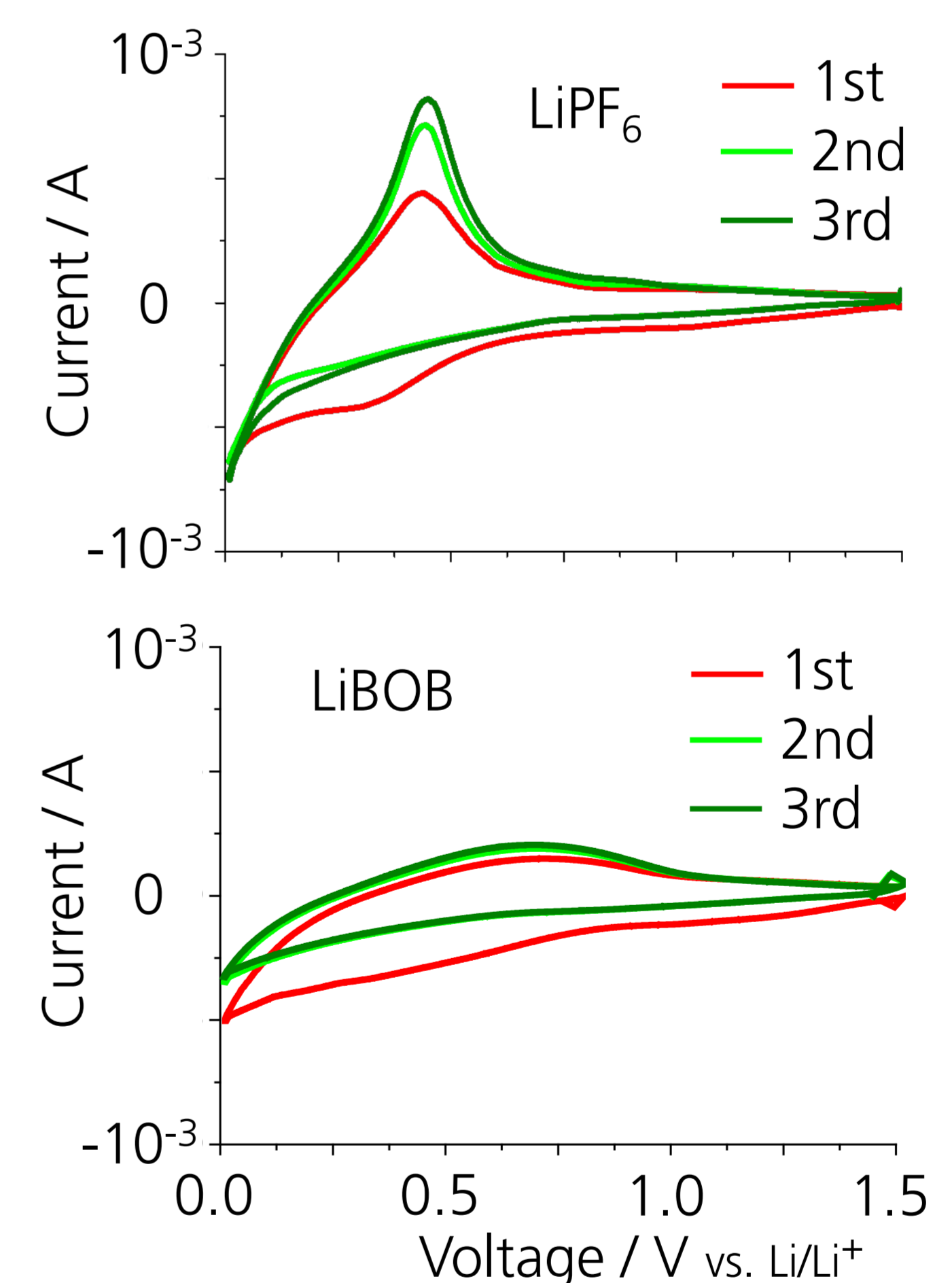
Infrared Spectra



- Spectra differ strongly depending on the used lithium salt
- Heterogeneous surface layer with LiBOB
- Li₂CO₃, alkyl carbonates and moieties of the lithium salts were detected

Cyclic Voltammograms

- Two possible decomposition reactions for EC at 0.8 and 0.5 - 0.8 V
- Single-electron reduction takes place at 0.8 V and leads to Li₂CO₃
- Double electrons reaction takes place at 0.5 - 0.8 V and leads to different alkyl carbonates (ROCO₂Li)
- SEI formation with LiBOB is less homogeneous



Conclusions

- SEI layers on graphite anodes were investigated with FTIR and CV measurements
- Both methods revealed a more heterogeneous formation of the SEI if LiBOB was used
- The composition of the SEI differs depending on the used lithium salt
- In contrast to LiPF₆ the anion of LiBOB is reduced during the first cycle
- As main products of the SEI formation Li₂CO₃, different alkyl carbonates and moieties of the lithium salt were identified

