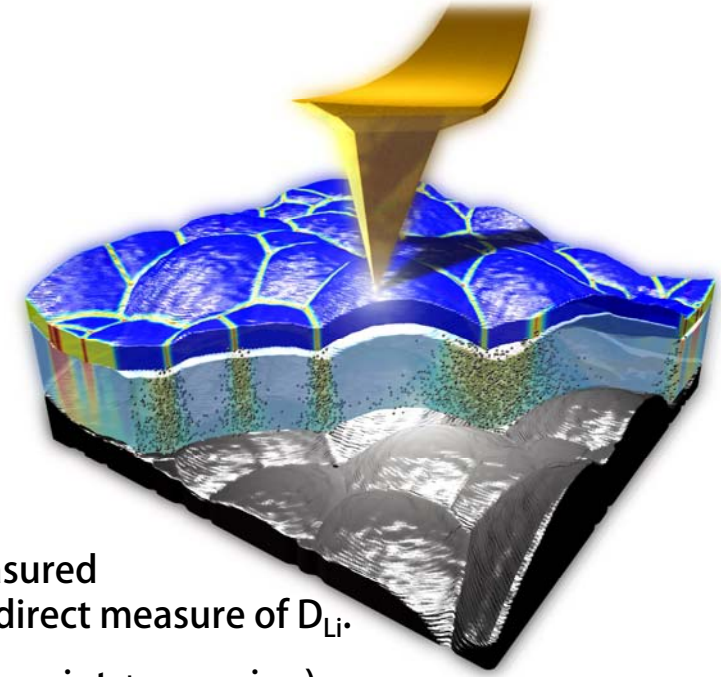
Tracking Li-ions on the nanoscale



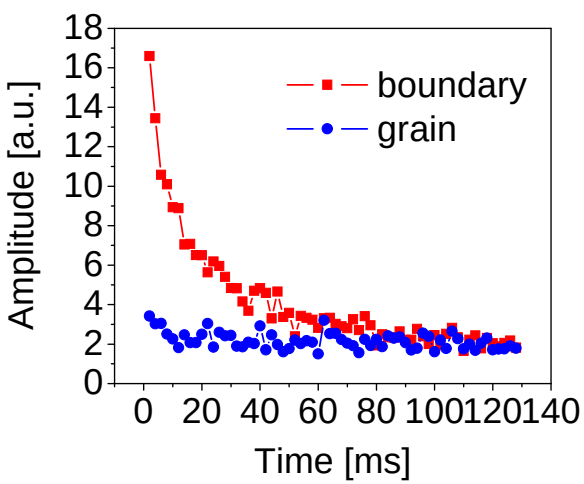
Goal: Measure Li-ion flow on the nanoscale using local detection of electrochemical strain.

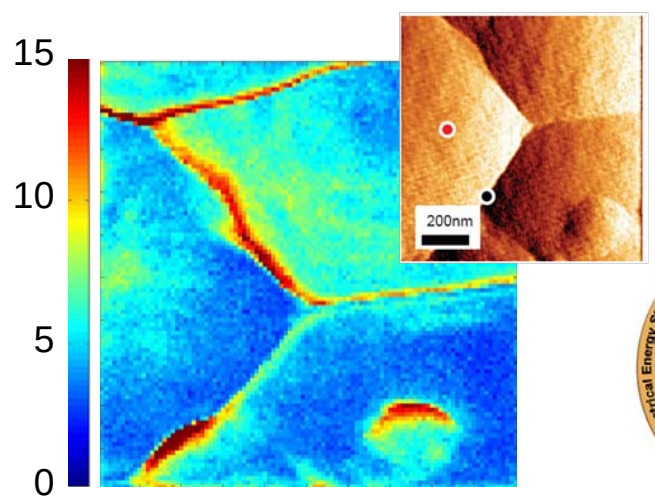
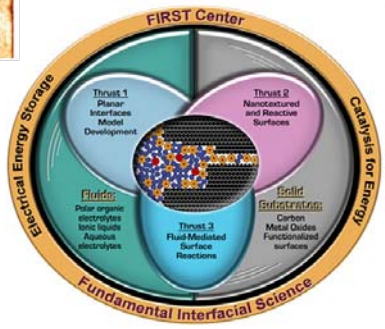
Significance: Understanding and identification of battery processes on the nanoscale can be used to establish structure-electrochemical functionality relationship on a single grain/defect level and will help to identify origins of battery failure to design better battery materials.

Electrochemical Strain Microscopy (ESM): Electrical fields are applied locally to a Scanning Probe Microscopy tip in contact with cathode materials or full battery stacks which results in a local Li-ion redistribution. Due to $V = f(c_{Li})$ a surface displacement (strain) is measured when c_{Li} is changed. The amplitude of the surface displacement is a direct measure of D_{Li}.

Operational modes: Time spectroscopy, voltage spectroscopy (single point + mapping)

Li-ion diffusion mapping and correlation with the micro-structure on LCO/LiPON/Si: Enhanced diffusion along boundaries in Si.

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