Materials structure-properties relation at atomic scale

Keywords: In situ electron microscopy, phase transition, mechanics, nano battery, nano transistor

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Background

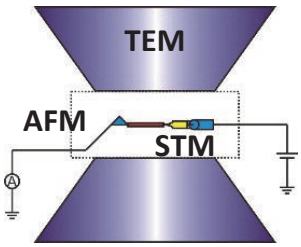
- The development of new materials relies on the fundamental understanding of the microstructures-properties relation at multiple length and time scales.
- However, conventional materials science is carried out following a separated synthesis-processing-measurement-characterization approach.

Aim

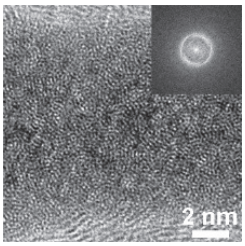
- Reveal the structure-properties relations at atomic scale by using the in situ electron microscopy technologies combined with theoretical simulations.
- Guide the design of new materials for structural and functioning applications.

Advanced Research Topics

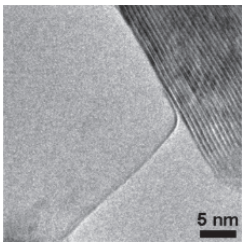
In situ TEM



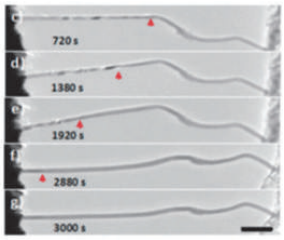
Phase transition



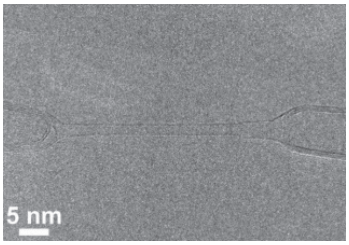
2D mechanics



Nano battery



Nano transistor



Publications

- 1. D.-M. Tang et al., Nano Lett. 15, 4922 (2015).
- 2. Y. Yang et al., Energy & Environmental Science 10, 979 (2017).
- 3. J. Han et al., Nat. Commun. 9, 402 (2018).

Summary

- In situ TEM method was developed to understand the structure-properties at atomic scale.
- Ultimate mechanical, thermal and electrical properties of the atomic structures were demonstrated.

Research outcome

- Reveal the structural transformations during materials processing at high spatial (nm) and temporal (ns) resolutions.
- Reveal the structure changes of electrode materials of lithium ion batteries.