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Topological defect dynamics in *operando* battery nanoparticles ANDREW ULVESTAD, SHIRLEY MENG, OLEG SHPYRKO, University of California: San Diego — Topological defects are ubiquitous in physics and manifest themselves as magnetic monopoles in quantum field theories and crystallographic imperfections in condensed matter systems. In the latter, the defect properties determine many of the material's properties and as such represent substantial novel opportunities for design and optimization of desired functionalities through deliberate defect engineering and manipulation. However, this approach of "defect choreography" currently suffers from the lack of suitable nanoscale probes to track buried single defects *in-situ* and *in-operando*. Here we report 3D imaging of single edge dislocations and their motion in an individual nanoparticle under *operando* conditions in a Lithium ion battery. We further observe the dislocation act as a nucleation point during the structural phase transformation. We find that the region near the dislocation enters a negative Poisson's ratio, or auxetic, regime at high voltage. Dislocation imaging is thus a powerful nanotechnology and it opens a new, powerful avenue for facilitating improvement of nanostructured devices.

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