Mesoscale Priority Research Direction

Dynamic Tomography: Polymers, Batteries, and H2 Storage

Opportunity

Mesoscale chemistry affects flame retardants in polymer blends, structures in lithium-ion batteries, and hydrogen storage in metal alloys. Classic tomography suffers from the "sit still" restriction. New data acquisition strategies based on the Greek golden section and similar now enable kinetic, 3D imaging studies.

Approach

Synchrotron and lab X-ray tomography with fast cameras, new mathematics, and both absorption and phase imaging strategies. Environmental sample chambers for real-world stresses. Workflow/provenance software to handle large data streams. Tomography beamlines at APS, NSLS II, and CAMD will develop techniques.

Meso Challenge

Observed void structures of flame retardants in polymer blends are on 10-100 micron scale and affect retardant success. Observed flaws in commercial batteries and H2 storage structure observed near 100 micron scale.

Impact

Emergent phenomenon at the mesoscale is a make/break point for practical devices and applications. In situ observation with kinetic, 3D imaging methods reveals these problems and offers insight to solutions.

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