Mesoscale Priority Research Direction

Interfacial Durability of Meso-Scale Systems

Opportunity

Electrode systems such as battery and fuel cell electrodes show degradation on the meso-scale which limits their functionality and usefulness. Electrode systems at the meso-scale level are complex mixtures (catalysts, supports, electrolyte, polymer (ionomer) and voids) ; the structure of which is not understood

Design of better materials for next generation energy storage and conversion devices can benefit from a better understanding of the driving forces at the mesoscale

Meso Challenge

Measuring and modeling phenomenon at this level to understand degradation mechanisms in electrochemical systems is challenging.

Interaction of solubility, surface energy, electrochemical potential, gas diffusion at the few to few hundred nm distance.

Approach

- Advanced experimental techniques to measure surface properties in electrochemical systems
- Neutron reflectivity and scattering measurements to identify interfacial changes of materials
- Measure material and electron transport across interfaces
- In situ measurement of changes in electrochemical systems including meso porosity

Impact

A fundamental understanding of degradation phenomenon at the mesoscale is critical in the development of durable electrochemical systems including fuel cells and batteries.

Definition of surface changes to Meso-scale systems such as electrode hydrophobicity will be design better electrolyte/electrode systems

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Teflon Distribution on Carbon Fiber Mats