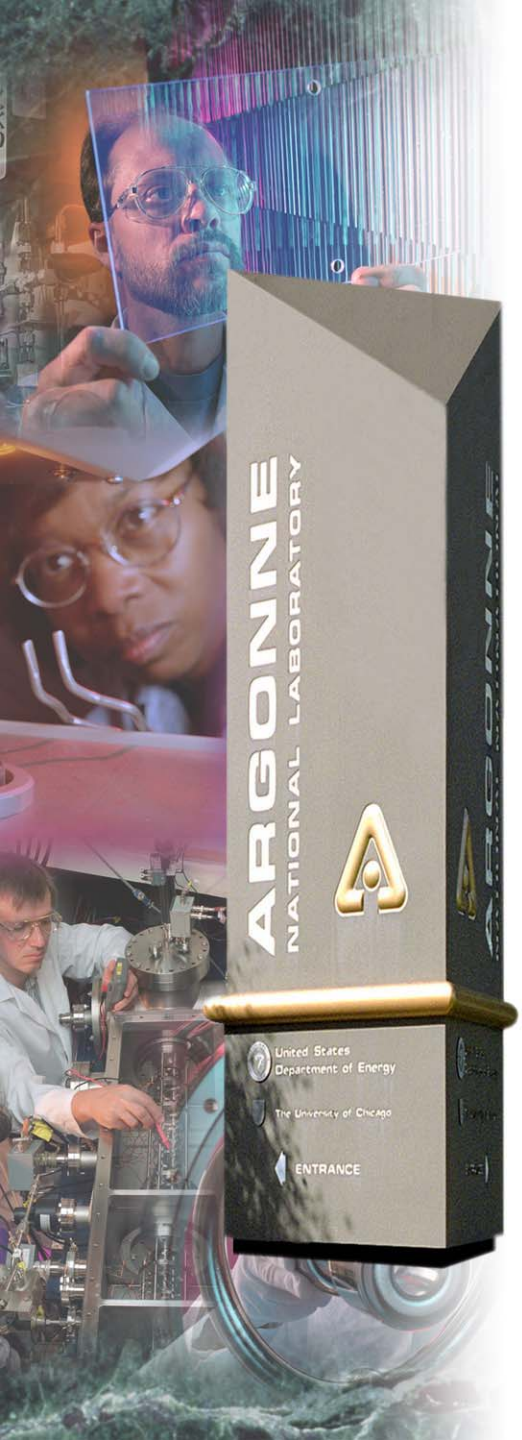

Challenges in Soft Materials Characterization

Millie Firestone

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Presented at the National Nanotechnology Initiative Workshop on X-ray and Neutron Essential Tools for Nanoscience Research

June 16-17, 2005, Washington, D.C.

Argonne National Laboratory

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U.S. Department of Energy

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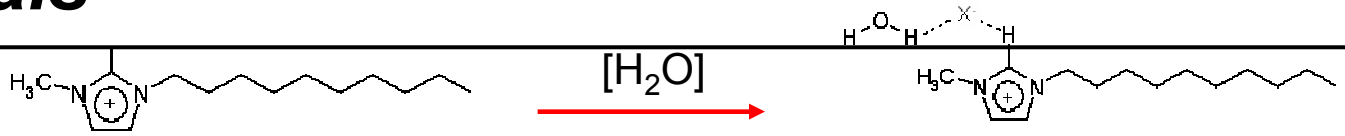
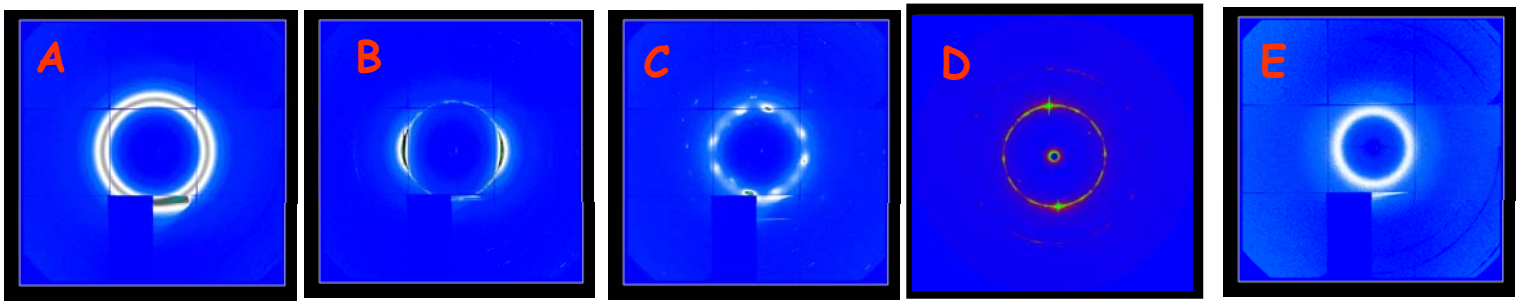
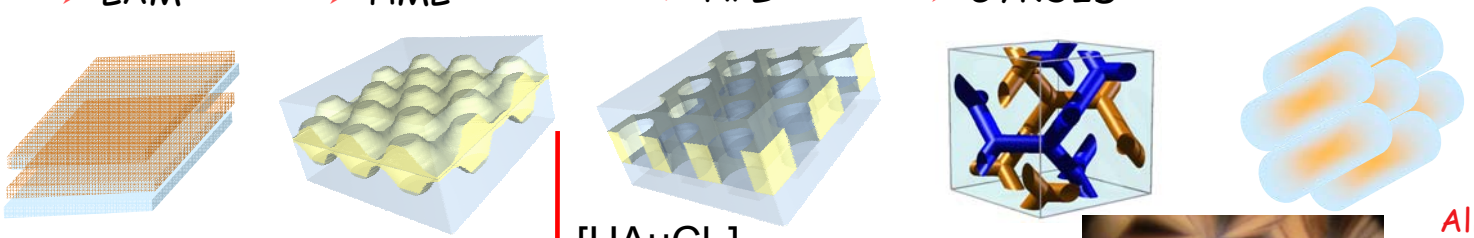
Self-Assembled IL-Based Nanostructured Materials





➢ LAM ➢ HML ➢ HPL ➢ GYROID ➢ HEX



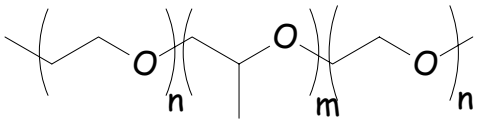
All Anisotropic gold nanoparticles !

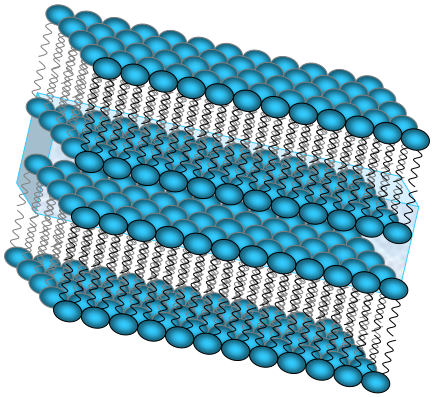
✓ wide variety of mesophase architectures readily obtained by controlled addition of water

✓ demonstrated that ILs can serve as soft nanostructured templates yielding anisotropic gold nanoparticles

Firestone, Dietz, Trasobares, Miller, Zaluzec. *Small* 2005, 1(7), 754-760

Association of Macromolecules with Lipid Bilayers

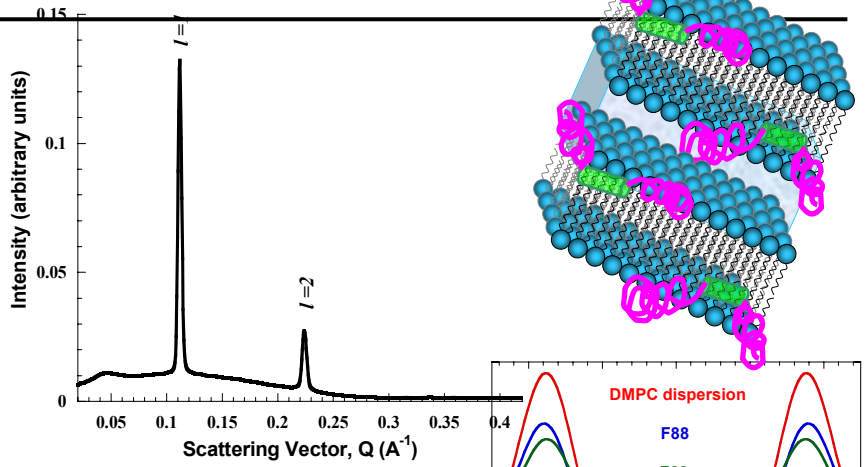


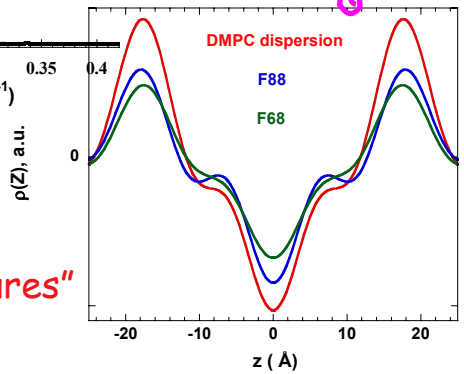


F68; m = 30; n = 75

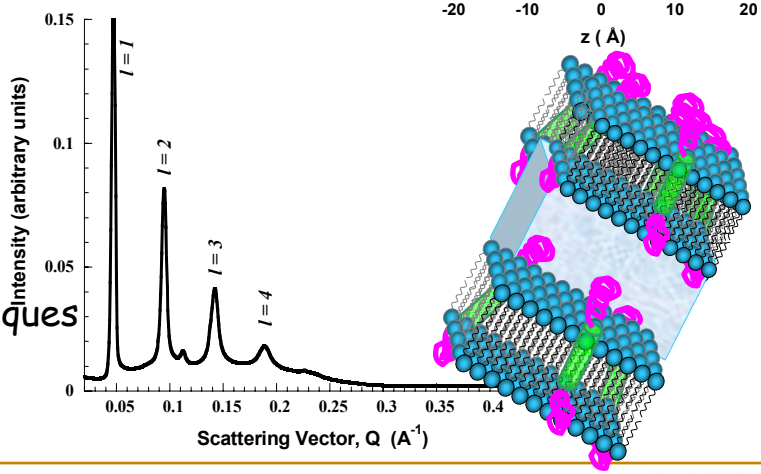
F88; m = 39; n = 103

"membrane sealer"





"robust nanostructures"



- Static structure
- What is the in-plane structure (rafts?)
- How does the structure evolve in time, under various external fields?
- Get beyond "model" membranes and apply scattering techniques to "real" systems

Firestone, Seifert. *Biomacromolecules* 2005, ASAP

Opportunities & Challenges for Soft Nanostructured Materials

- *in-situ* studies of self-assembly – "unlock the rules" for amphiphile SA
- multi-length scale structural probes
- multi-time domain probes
- "buried" interfaces – how does support/substrate impact bulk structure?
- integration of techniques for structure-function correlations

- more realistic model biomembrane systems – hydration, bilayer, unsupported
- in-plane structure determination (imaging and focused beam)

- analysis software is lacking
- investment in detectors is needed – sensitive, fast, ultra-low background
- radiation damage
- sample environment – temperature, pressure, external fields, low background