

NCMC-9 Discussion Session

Industrial Measurement Needs for Nanostructured Materials



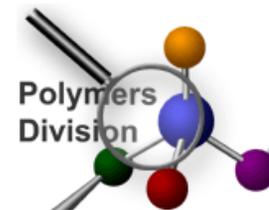
NIST Combinatorial Methods Center

NIST Gaithersburg, MD

April 24, 2006

NIST

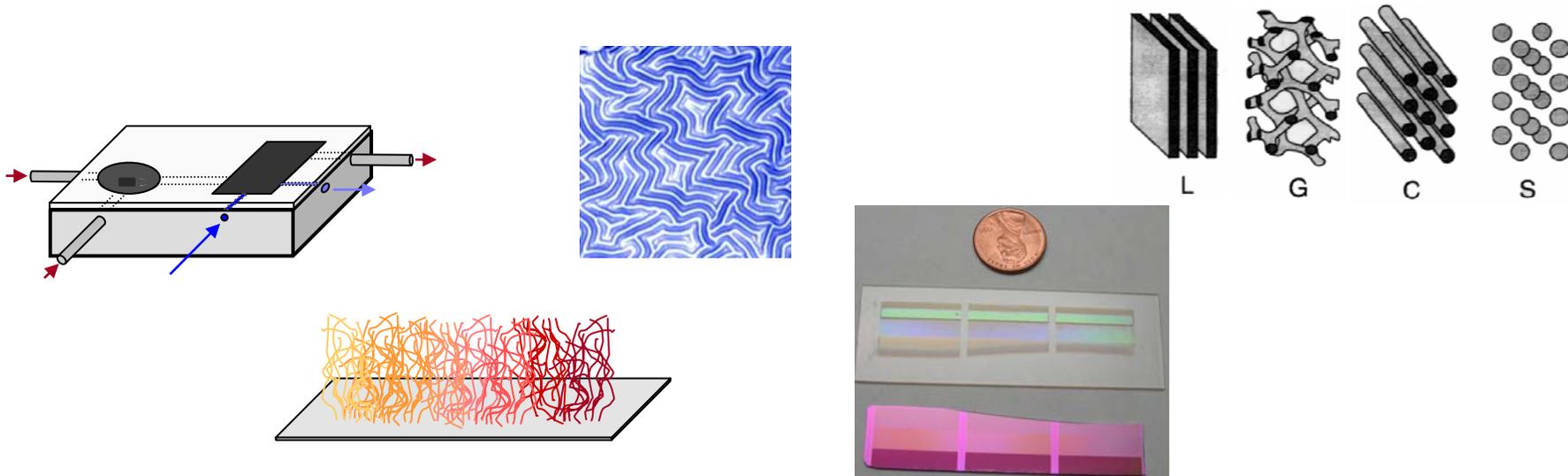
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce



Discussion Goals



- Discuss key measurement needs in industrial development and application of nanostructured materials
- Arrive at priorities for the development of combinatorial and high-throughput measurement methods for nanostructured materials

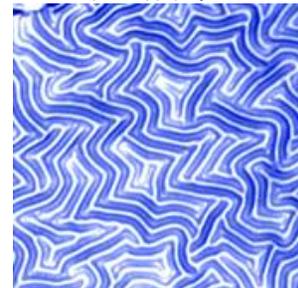


Scope of Metrology Needs



- In your company, what aspects of *nanomaterials* development or application require new or improved measurement methods?
 - Basic R&D: design and testing of custom fabricated materials
 - Evaluation of raw materials from internal or external suppliers
 - Formulation of products with nanostructured components
 - Performance of new products
 - Testing of manufacturing and/or processing routes
 - Quality control and/or failure
 - Others?
- Of these aspects, where would *new* combinatorial and HT measurement capabilities be most important?

Thin Film Modulus

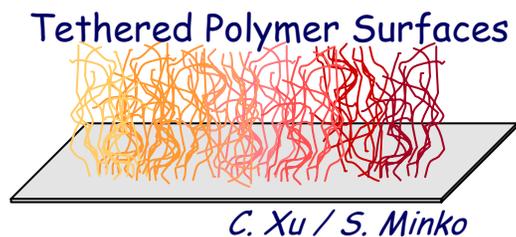


C. Stafford

Key Materials Properties



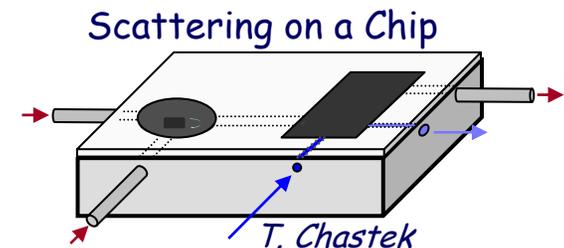
- What new materials' property information is critical for development or application of nanomaterials in your company?
 - Nanoparticles: size, morphology, dispersion, location
 - Polymer colloids/micelles: morphology, size, phase behavior
 - Nanostructured fluids: morphology, rheology, stability
 - Thin films/multilayers: morphology, defects, adhesion, mechanical properties
 - Surfaces and interfaces: chemistry, morphology, adhesion, stability
 - Polymer self-assembly: morphology, defects, phase behavior
 - Electronic and opto-electronic properties
 - Others?
- Of these properties, for which is it critical that *new* combinatorial/high-throughput methods be developed or improved?
 - Library fabrication methods
 - HT or parallel measurement methods



Key Test Methods



- What measurement tools and instruments do you currently find most useful for nanomaterials testing and analysis?
 - Scattering: Light, X-ray, Neutron
 - Scanning Probe Microscopy: AFM, STM, advanced modes
 - Image Analysis: Microscopy, Multispectral.
 - Thickness Methods: Reflectometry, Profilometry, Ellipsometry
 - Electron Microscopy: Transmission (TEM), Scanning (SEM), STEM
 - Spectroscopic Techniques: UV-vis, IR, Raman
 - Surface analysis: X-ray photoelectron spectroscopy (XPS), Secondary Ion Mass Spectrometry (SIMS)
 - Others?
- Are existing test methods/strategies adequate for nanomaterials analysis?

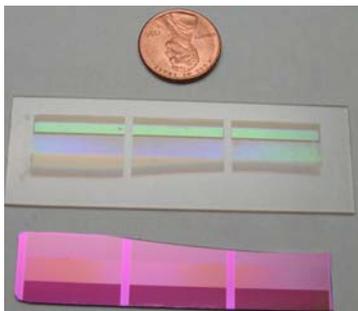


Key Test Methods, cont.



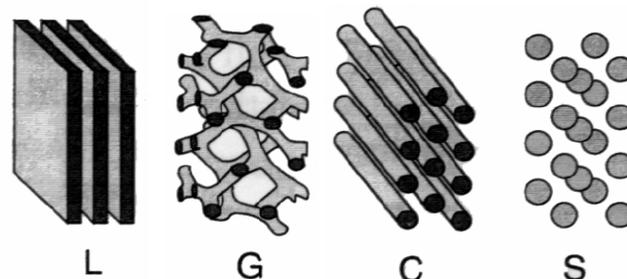
- Of tools you use for nanomaterials analysis, which one would be most valuable if it were developed into a combinatorial/high-throughput measurement technique?
- What *entirely new* test needs to be developed? What *entirely new* combi/high-throughput test needs to be developed?

Nanoimprint Lithography



C. Stafford

Block Copolymer Self Assembly



T. Epps / M. Fasolka