

NCMC-9

Discussion Summary and Redux

*Industrial Measurement Needs
for Nanostructured Materials*



NIST Combinatorial Methods Center

NIST Gaithersburg, MD

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NIST

National Institute of Standards and Technology
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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?

- **Formulation of products with nanostructured components**
 - Evaluation of raw materials from internal or external suppliers
 - Performance of new products
 - Testing of manufacturing and/or processing routes

Of these aspects, where would *new* combinatorial and HT measurement capabilities be most important?

- Library fabrication routes that express formulated products and processing variables
 - Reliable and repeatable fabrication
 - Appropriate scale for both combi and reliable testing

Key Materials Properties



What new materials' property information is critical for development or application of nanomaterials in your company?

- Nanoparticles: size, morphology, **chemistry**, dispersion, location, mechanical properties (of particles, of systems)
- Polymer colloids/micelles: morphology, size, phase behavior
- Nanostructured fluids: morphology, **rheology, stability**
- Surfaces and interfaces: chemistry, interfacial tension, stability

Of these properties, for which is it critical that *new* combinatorial/high-throughput methods be developed or improved?

- Library fabrication methods specifically for nanostructured materials
- Complex Rheology
- Nanoscale morphology - particle size, morphology, chemistry, dispersion....



What measurement tools and instruments do you currently find most useful for nanomaterials testing and analysis?

- Electron Microscopy: **TEM, SEM**
 - Morphology, particle sizing and analysis
- Rheology: **Performance properties and structure**
- Scanning Probe Microscopy: Basic AFM, advanced modes seem interesting but not yet robust
- Scattering: Light, X-ray
 - Fluid structure, particle sizing
- Surface Methods: Reflectometry
- Spectroscopic Techniques: UV-vis, Raman
 - **Tools for particle sizing, chemistry**

Are existing test methods/strategies adequate for nanomaterials analysis?

- Not with respect to C&HT
 - Appropriate, reliable library/sample preparation

Key Test Methods, cont.



Of tools you use for nanomaterials analysis, which would be most valuable if it were developed into a combinatorial/high-throughput measurement technique?

- Library preparation techniques for TEM, AFM, SEM, Rheology, others
- HT TEM, AFM, SEM Measurements?
- HT Complex rheometry
- Equipment for automated/multispecimen scattering - light, x-ray

What *entirely new* test needs to be developed? What *entirely new* combi/high-throughput test needs to be developed?

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Additional Thoughts?



- *On yesterday's discussion*
- *On today's presentations*
- *On NCMC-9*

How we will proceed:

- A summary report of discussion findings will be produced
- This will be distributed to attendees for additional feedback
- An additional report, incorporating feedback and some possible points of response will be produced and distributed.
 - NCMC Focus Projects
 - USMS Measurement Needs statements