Metrology of Lignocellulosics

Group 5 – Breakout session
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The Unique Problem

• Unlike conventional nanostructures often assembled in 2-D in controlled environments (eg. Hard disk), lignocellulosic products are self-assembled in noisy processes creating complex structures.

• Better characterization of these structures will facilitate improved engineering through nanotechnology
Need for Metrology

- Measurement at the nanoscale is the cornerstone of nanotechnology.
- Without proper characterization techniques it is not possible to explore this area.
Goal Statement

• The overall goal of the analytical methods focus area is to develop the nanoscale characterization methods and physical (mechanical, electrical, magnetic, optical) and chemical property measurements and techniques necessary to adequately characterize complex lignocellulosic materials, alone or used in conjunction with other organic or inorganic materials at the nanoscale in three dimensions over relevant time and length scales.
Objectives

Characterize the relevant chemical and mechanical properties of bonding at interfaces in lignocellulosic materials at the nanoscale. Interfaces include:

- cellulose-cellulose
- cellulose-inorganic
- cellulose-synthetic polymers
- cellulose-lignocellulose matrix polymers
Objectives

- Develop a “whole body imaging” technique for lignocellulosic nanostructures with sub-nanometer resolution. Characterize and image directed self assembled nanoporous materials in three dimensions.
  - Pore dimensions
  - Pore wall functionality
Objectives

- Develop methods to determine the long-term stability of lignocellulosic nanostructures and their subsequent impact on the environment and health:
  - Degradation products
  - Degradation mechanisms
Objectives

• Develop a research community-wide mechanism to ensure that existing technologies are being applied to the study of lignocellulosic nanostructures.
  – Standardized methodology for measuring lignocellulosic materials on the nanoscale
  – Meetings
  – Abstract service
Objectives

- Development of robust, rapid, and inexpensive characterization methods for lignocellulosic nanostructures.
  - Development of a simple 3-D image analysis tool for education
  - Dynamics of nano assembly under high speed processing
Objectives

- Development of specific labeling techniques for lignocellulosic biopolymers that facilitate or augment existing analytical methods including:
  - Locating biopolymers in the cell wall