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Nanomaterials: Electronic, Photonic, and Bionic Applications

Civil Engineering—Wood Materials and Engineering Laboratory

Marie-Pierre Laborie

Nanoscale Engineering of Bio-based Composites

Numerous studies suggest that nanoscale characteristics govern the processing and end-use performance of biopolymers and bio-based composites. Unfortunately, the structural complexity of biomaterials often complicates the use of common analytical methods for identifying nanoscale properties. In this perspective our research aims at:

- Developing molecular tools for the nanoscale characterization of biomaterials.
- Engineering the nanoscale behavior of biomaterials towards targeted performance.

Modeling molecular relaxation is one valuable approach for assessing intermolecular interactions and nanoscale morphology in synthetic

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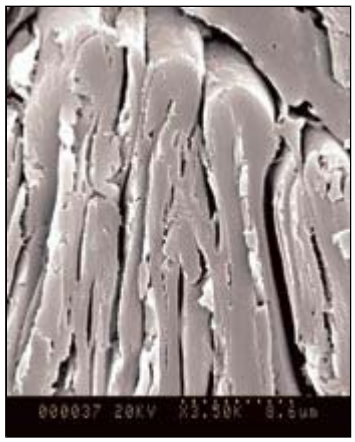
Dr. Marie-Pierre Laborie received an engineering degree in wood science from University of Nancy I, France, in 1996. In 2002 she received a Ph.D. in wood science and forest products at Virginia Polytechnic and State University. During her Ph.D. she

polymer blends. Such an approach has great potential for biopolymers and bio-based composites. Recently, our group demonstrated the validity of a coupling model of relaxation for lignocellulosic polymers. With the coupling model of relaxation, insight on the nanophase behavior of various bio-based composites was obtained. Modeling research on relaxation mechanisms in biopolymers and bio-based composites is thus actively pursued at the Wood Materials and Engineering Laboratory. Method development for the nanoscale characterization of biomaterials also focuses on Solid State Nuclear Magnetic Resonance (CP/MAS NMR) techniques. The interest of CP/MAS NMR is that specific labeling of polymers can be achieved affording a local probe of relaxation mechanisms in bio-based composites.

With these molecular probes, nanoscale properties can be characterized in biopolymers and bio-based composites. In addition, formulation and processing parameters can be manipulated for designing the interphase morphology of bio-based composites on a nanometer scale. For instance, our group currently investigates the influence of chemical structure, architecture and molecular weight of different coupling agents on the nanoscale morphology of bio-based composites.



focused on the nanoscale interphase morphology in composites of synthetic and lignocellulosic polymers. Dr. Laborie joined the Wood Materials and Engineering Laboratory (WMEL) at Washington State University in fall 2002. Her contribution to nanotechnology resides in the molecular scale engineering of nanoscale properties in bio-based composites. Her research has been published in Holzforschung and was awarded a best paper at the sixth Pacific Rim Bio-Based Composite Symposium. Dr. Laborie has served as a reviewer for the journals Composites Part A: Applied Science and Manufacturing and for Wood and Fiber Science.

Contact Information

Marie-Pierre Laborie, Ph.D.
Assistant Professor

Civil and Environmental Engineering
PO Box 641806
Pullman, WA 99164-1806

Telephone:509-335-8722
E-mail: mlaborie@wsu.edu