Graduate Program Overview

Wood and paper science

nc state university
Department Overview

Department of Wood and Paper Science

- Paper Science and Engineering
- Wood Products
Paper Science and Engineering

- 125 undergraduate students
  - Dual chemical engineering degree is unique in US
  - Options in chemistry, textiles, environmental science, business
- 40 graduate students
- 115 endowed scholarships
Paper Science and Engineering

- 14 faculty
- 11 research associates
- $2 million in research expenditures
Wood Products

- 35 undergraduate students
- 10 graduate students
- 4 teaching/research faculty
- 3 extension faculty
- 2 research faculty
<table>
<thead>
<tr>
<th>Faculty</th>
<th>Title</th>
<th>Education</th>
<th>Research Interests</th>
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<tbody>
<tr>
<td>Dimitri Argyropoulos</td>
<td>Professor</td>
<td>Organic Chemistry</td>
<td>Wood Chemistry &amp; Biopolymers</td>
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<tr>
<td>David Ashcraft</td>
<td>Instructor</td>
<td>Chemical Engineering</td>
<td>Business Management</td>
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<tr>
<td>Hou-min Chang</td>
<td>Distinguished Professor</td>
<td>Wood Chemistry</td>
<td>Wood Chemistry &amp; Biopolymers</td>
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<tr>
<td>Vincent Chiang</td>
<td>Professor</td>
<td>Biochemistry</td>
<td>Forest Biotechnology</td>
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<tr>
<td>Med Byrd</td>
<td>Assistant Professor</td>
<td>Paper Science &amp; Engineering</td>
<td>Fiber Processing</td>
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<tr>
<td>Richard Gilbert</td>
<td>Professor Emeritus</td>
<td>Organic Chemistry</td>
<td>Cellulose &amp; Surface Science</td>
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<td>John Heitmann</td>
<td>Professor</td>
<td>Paper Science &amp; Engineering</td>
<td>Bio-Processing &amp; Papermaking</td>
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<tr>
<td>Martin Hubbe</td>
<td>Associate Professor</td>
<td>Chemistry</td>
<td>Colloid &amp; Surface Science</td>
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<tr>
<td>Hasan Jameel</td>
<td>Professor</td>
<td>Chemical Engineering</td>
<td>Process Engineering &amp; Fiber Process</td>
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<td>Adrianna Kirkman</td>
<td>Professor</td>
<td>Paper Science &amp; Engineering</td>
<td>Simulation &amp; Modeling</td>
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<td>Michael J. Kocurek</td>
<td>Professor</td>
<td>Paper Science &amp; Engineering</td>
<td>Workforce Education &amp; P&amp;P Techn</td>
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<tr>
<td>Lucian Lucia</td>
<td>Associate Professor</td>
<td>Organic Chemistry</td>
<td>Wood Chemistry &amp; Biopolymer</td>
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<tr>
<td>Joel Pawlak</td>
<td>Assistant Professor</td>
<td>Paper Science &amp; Engineering</td>
<td>Paper Physics &amp; Material Science</td>
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<tr>
<td>Orlando Rojas</td>
<td>Assistant Professor</td>
<td>Chemical Engineering</td>
<td>Engineering &amp; Materials Science</td>
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<tr>
<td>Richard Venditti</td>
<td>Associate Professor</td>
<td>Chemical Engineering</td>
<td>Recycling &amp; Material Science</td>
</tr>
<tr>
<td>M.K. Ramasubramanian</td>
<td>Associate</td>
<td>Mechanical Engineering</td>
<td>Tissue, Packaging, Mechatronics</td>
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Research Program

cidencescence

nc state university
Raw Materials  Wood Chemistry  Fiber Processing

paperscience nc state university

Materials  Papermaking
Raw Materials

- Relationships between fiber and product characteristics
- Impact of natural variations in raw material and effect on end use properties
- Genetic modifications to improve process and product performance
Raw Materials

Performance and Value of CAD-Deficient Pine

Genetic Variation of Fiber Components and Morphology in Juvenile Loblolly Pine

- Improved Wood Properties through Genetic Manipulation: Engineering of Syringyl Lignin in Softwood Species
- Wood and Fiber Quality of Juvenile Pine: Characterization and Utilization
- Genetic Variation and Structural Characterization of Cellulose, Hemicellulose and Lignin in Elite Pine
- Impact of Transgenic Trees on Fiber Properties and Paper Mill Economics
- Pulping and Papermaking Properties of Arundo Donax
Wood Chemistry

- Understand the biosynthetic pathways of wood components
- Chemical properties of the raw material
- Reaction mechanism for pulping, bleaching and papermaking
- Modification of fiber components for new end uses
Wood Chemistry

- Polysulfide Chemistry in Pulping
- Development of Novel Oxidation Catalysts
- Development of Analytical Methods for the Rapid Measurement of Wood Components
- Characterization of Residual Lignin after Pulping and Bleaching
- Supercritical Oxidations and Extractions of Pulping Streams
- Value Added Pathways to Lignin
- Selective Removal of Value-added Compounds from Ligno-cellulosic Feedstocks
Fiber Processing

- Understand the underlying principles of various unit operations:
  - Pulping
  - Bleaching
  - Recycling

- Develop new improved technologies for economic and environmental benefits

- Use of process simulation and modeling for
  - Economic evaluation
  - Process optimization
Fiber Processing

- Mill Integration-Pulping, Steam Reforming and Direct Causticization for Black Liquor Recovery
- Impact of Lignin Characteristics on Reject Formation in Hardwoods
- Increasing Yield and Quality of Low-Temperature, Low-Alkali Kraft Cooks with Microwave Pretreatment
- High Selectivity Oxygen Delignification
- Green Liquor Pretreatment for Yield Increase
- Fiber Fractionation in Hydrocyclones and Screens
- Removal of Pressure Sensitive Adhesive Contaminants in Screening Operations
- Automatic Sorting of Wastepaper
- Dry Strength Additives and Strength Properties of Recycled Paper
- Fundamental Behavior of Surfactants in Paper Recycling
Papermaking

- Understanding and implementing the principles of papermaking
  - Wet End Operations
  - Drying
  - Coating
  - Tissue Making and Creping
Papermaking

- Modification of Fiber Flexibility to Improve Tissue Softness
- Reversibility of Fiber Flocculation
- Dry Strength Treatment Strategies using Novel Coating Technologies
- Effect of Hydrodynamic Shear on Efficiency of Retention Aid
- Absorption Behavior of Surfactants and Polymers on Solid/Liquid Interfaces
- Impact of Fiber Fines on Drainage
- Development of Charge Titration Methods
- Adhesion Forces between Inorganic and Cellulose Surfaces
- Impact of Fiber Properties on Water Retention and Drying
- Polyampholytes as a Dry-strength Agents
Materials

- Improvements in the end use properties of paper
- Modification of surfaces to impart unique properties
- Development of novel uses of cellulose, lignin, hemicellulose and extractives
- Chemicals, monomers and solvents from biomass
- Forest biomaterials initiative
Improved Dimensional Stability of Fibers Through Selective Enzymatic Degradation

Compounding of Wood Fibers and Synthetic Polymers for Packaging

Micro and Nano-Cellular Foaming of Wood and Wood Fibers

Microcellular Starch Fillers

Effect of Cellulose Mesophase Structure on Regenerated Cellulose Fiber Properties: A Role of Shear Induced Stresses

Low Cost Process for Value Added Regenerated Cellulose Products from Biomass Residues

Antimicrobial Paper

Derivatization and Use of Lignin as Polymeric Surfactant

Conversion of Ligno-cellulosic Feedstocks to Ethanol