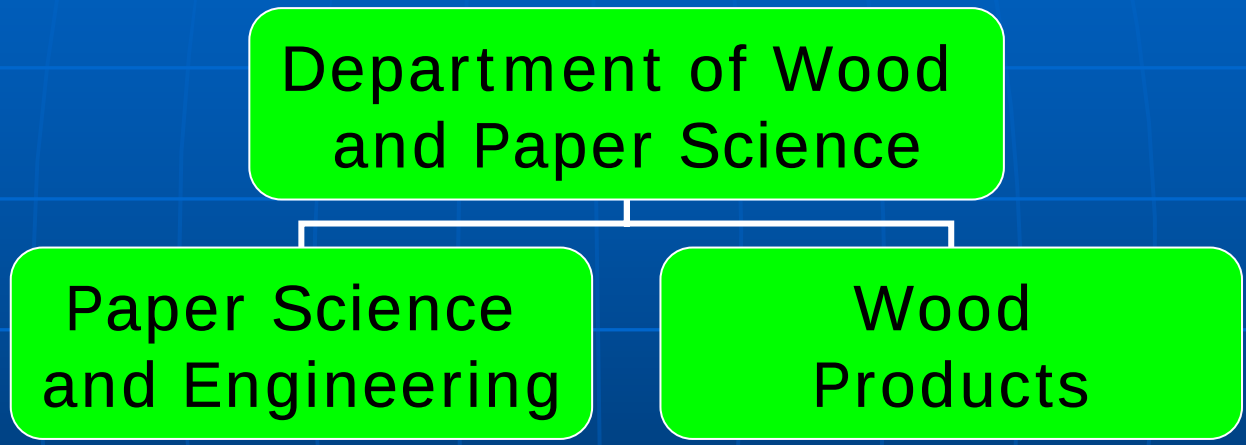
Graduate Program Overview

Wood and paper *science*

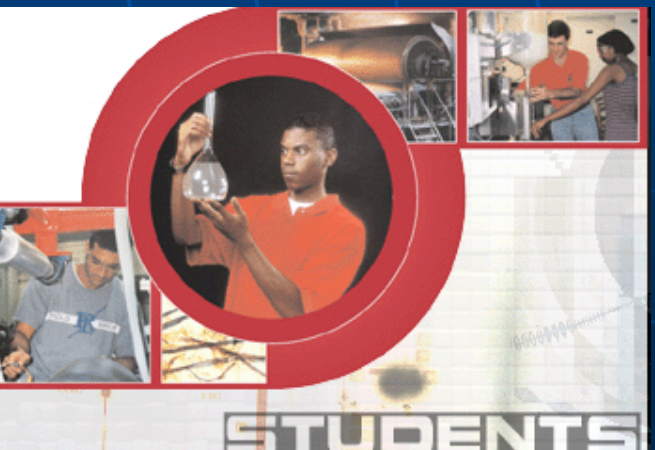
nc state university

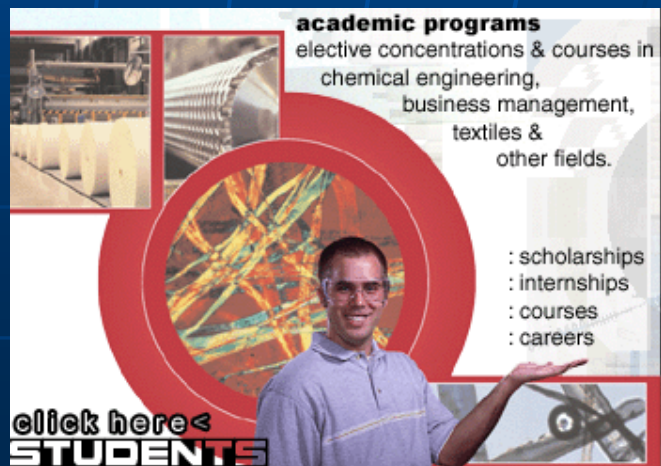
Department Overview



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

PS&E Faculty

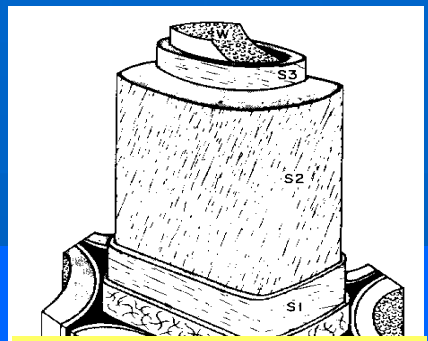
Faculty	Title	Education	Research Interests
Dimitri Argyropoulos	Professor	Organic Chemistry	Wood Chemistry & Biopolymers
David Ashcraft	Instructor	Chemical Engineering	Business Management
Hou-min Chang	Distinguished Professor	Wood Chemistry	Wood Chemistry & Biopolymers
Vincent Chiang	Professor	Biochemistry	Forest Biotechnology
Med Byrd	Assistant Professor	Paper Science & Engineering	Fiber Processing
Richard Gilbert	Professor Emeritus	Organic Chemistry	Cellulose & Surface Science
John Heitmann	Professor	Paper Science & Engineering	Bio-Processing & Papermaking
Martin Hubbe	Associate Professor	Chemistry	Colloid & Surface Science
Hasan Jameel	Professor	Chemical Engineering	Process Engineering & Fiber Process
Adrianna Kirkman	Professor	Paper Science & Engineering	Simulation & Modeling
Michael J. Kocurek	Professor	Paper Science & Engineering	Workforce Education & P&P Techn
Lucian Lucia	Associate Professor	Organic Chemistry	Wood Chemistry & Biopolymer
Joel Pawlak	Assistant Professor	Paper Science & Engineering	Paper Physics & Material Science
Orlando Rojas	Assistant Professor	Chemical Engineering	Engineering & Materials Science
Richard Venditti	Associate Professor	Chemical Engineering	Recycling & Material Science
M.K. Ramasubramanian	Associate	Mechanical Engineering	Tissue, Packaging,Mechatronics

Research Program

paper*science*

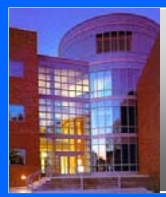
nc state university

Raw Materials



Wood Chemistry

Fiber Processing



paperscience

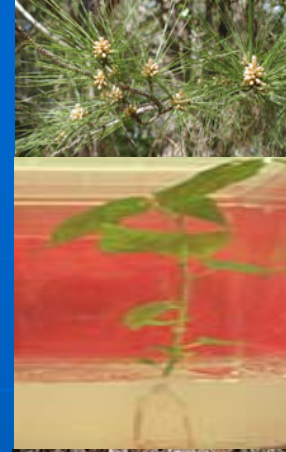
nc state university

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



Hou-min Chang
Vincent Chiang
Hasan Jameel
Joel Pawlak
Lucian Lucia
Dimitris Argyropoulos

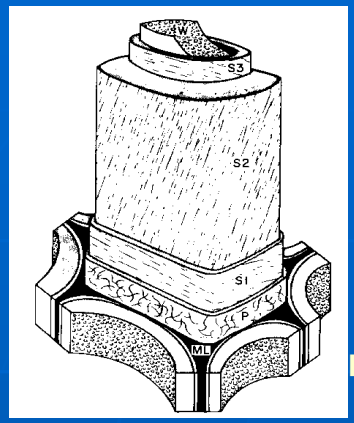
Raw Materials

- *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*

DOE

USDA

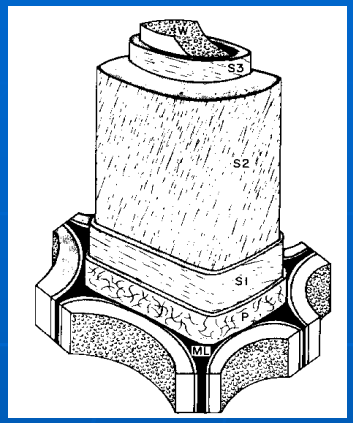
Industry Partners



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

Hou-min Chang
Vincent Chiang
Lucian Lucia
Dimitris Argyropoulos
Hasan Jameel
Med Byrd



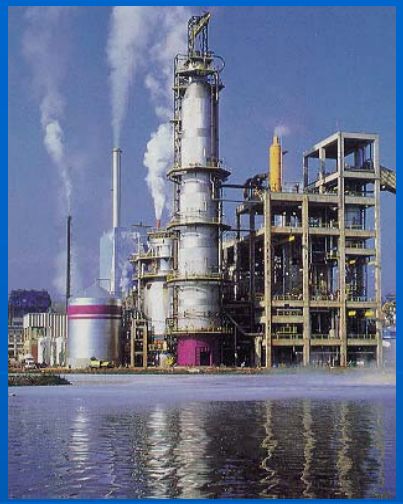
Wood Chemistry

- *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*

USDA

NC Biotechnology

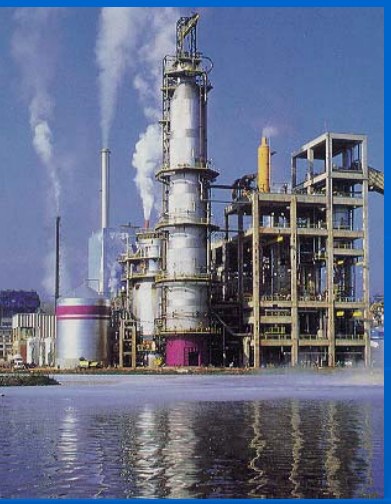
Industry Partners



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

Richard Venditti
Adrianna Kirkman
Med Byrd
Hou-min Chang
Lucian Lucia
Dimitris Argyropoulos
Hasan Jameel
John Heitmann



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*

DOE

AF&PA

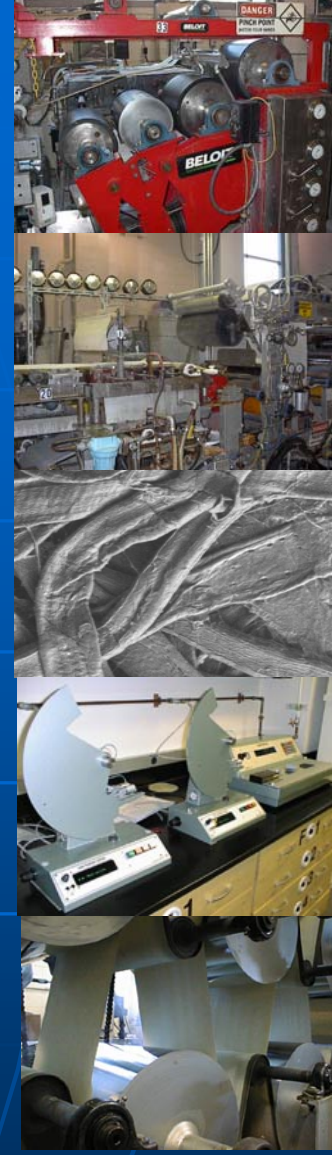
CPBR

National Labs

Industry Partners

Papermaking

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



John Heitmann
Marty Hubbe
Joel Pawlak
Orlando Rojas
Richard Venditti
Ramasubramanian

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*

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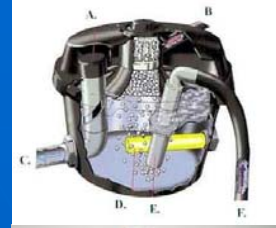
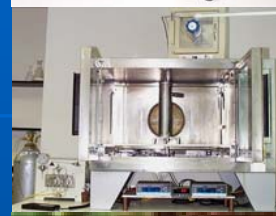
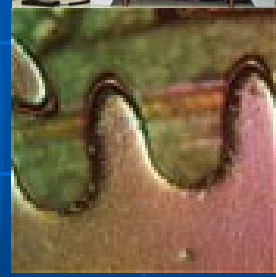
Industry Partners

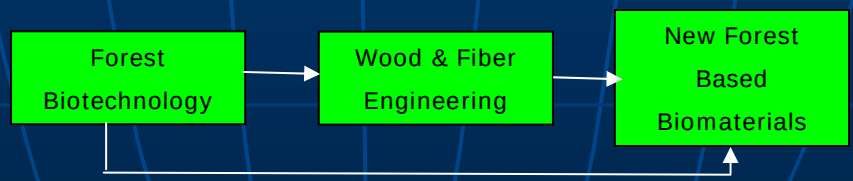
Materials







- 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



Dimitris Argyropoulos
Richard Venditti
Hou-min Chang
Lucian Lucia
Joel Pawlak
John Heitmann
Hasan Jameel
Orlando Rojas

Materials

- *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*

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Industry Partners

Department of Chemical Engineering

Kenan Center for the Utilization of CO_2 in Manufacturing

Joel Pawlak

Richard Venditti

Duke University

ncasi

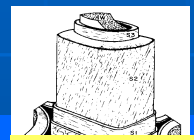
RTI International

Department of Forestry, NC State University
Forestry - Natural Resources
Fisheries and Wildlife - Environmental Technology - Hydrology

NONWOVENS COOPERATIVE RESEARCH CENTER

College of Textiles

Raw Materials



Wood Chemistry

Fiber Processing

Mechanical Engineering

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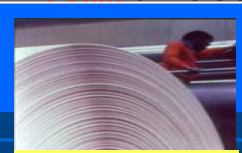
nc state university

Materials



Papermaking

Department of Chemistry

NanoTechnology Center

Analytical Instrumentation Facility

Department of Industrial Engineering

materials science & engineering

Forest Biotechnology

Department of Chemical Engineering

Kenan Center for the Utilization of CO_2 in Manufacturing

Duke University

ncasi

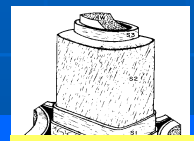
RTI International

Department of Forestry, NC State University
Forestry - Natural Resources
Fisheries and Wildlife - Environmental Technology - Hydrology

NONWOVENS COOPERATIVE RESEARCH CENTER

College of Textiles


Raw Materials


Wood Chemistry


Fiber Processing

Mechanical Engineering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nc state university


NanoTechnology Center

Materials


Papermaking

Department of Chemistry

Analytical Instrumentation Facility

Department of Industrial Engineering

materials science & engineering


Forest Biotechnology