UGA Core Research Competencies for Textile Materials and Product Development

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Program Mission

To leverage UGA’s outstanding expertise in textiles, polymers and fibers, collaborating with industry, especially small and medium enterprises. UGA is interested in supporting, incubating and launching new businesses, and to develop new materials based on green engineering principles. This presentation highlights the following research teams affiliated to the Textiles, Merchandising and Interiors department: New Materials Institute, the Nonwoven Functional Materials Lab, the Innovative Materials Research Team, the Nano-Structured Materials lab and the Product Design and Development lab.

Contact information of UGA textiles research professors:

- Dr. Sergiy Minko (sminko@uga.edu)
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Section I
Summary
### Core Competencies

#### Computer Aided Design for Integrated Textiles
- 3D Printing
- 3D-printing of preforms
- CAD design
- Integrated fabric design automation
- Modeling
- Multi physics modeling
- Product design

#### Fiber Yarn Devices
- Fiber production
- Fiber, yarn, and fabric testing, standardization, and in-line inspection
- Fiber & Yarn Dyeing
- Preform Fabrication
- Thread manufacturing
- Yarn formation
- Yarn spinning

#### Textiles
- Air-Laid nonwoven fabrics
- Bonded-fiber nonwoven fabrics
- Carded nonwoven fabrics
- Coating
- Coating and lamination materials
- Dyeing
- Fabric weaving
- Finishing knit fabric
- Melt blown nonwoven fabrics
- Nonwoven fabrics
- Surface treatment of textiles
- Wet-laid nonwoven fabrics

#### System Integration and Testing
- E-Textiles
- Fabric Testing - physical, mechanical, and chemical properties
- Fiber, yarn, and fabric testing
- Fiber & Yarn Testing - physical, mechanical and chemical properties
- Optical test
2. Market Applications

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Accessories</td>
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<tr>
<td>Apparel</td>
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<td>Construction Commercial &amp; Residential</td>
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<td>Defense and military</td>
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<td>Sports &amp; fitness</td>
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<td>Technical Fabrics</td>
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<tr>
<td>textile</td>
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<td>Textile Modification (dyeing, finishing and coating)</td>
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<td>Textiles Testing</td>
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<tr>
<td>Wellness</td>
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<td>Work &amp; Safety Wear</td>
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<tr>
<td>Equipment</td>
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<tr>
<td>6 inch Melt Blowing Line</td>
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<tr>
<td>Altas Weather-meter</td>
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<td>Bench top autoclave</td>
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<td>Bispectral fluorescence colorimeter</td>
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<tr>
<td>Compound polarizing and stereo zoom microscopes</td>
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<tr>
<td>DLS particle size analyzer Zetasizer</td>
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<tr>
<td>Electro-spray and spinning system</td>
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<tr>
<td>GEEETech/L3 3D Printer</td>
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<tr>
<td>Hand Knitting Machine</td>
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<tr>
<td>IR-spectrometer</td>
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<td>Launderometer</td>
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<tr>
<td>MCR 302 Modular Anton Paar (magneto-) rheometer</td>
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<td>Modular microcalorimetric systems TA Instruments</td>
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<tr>
<td>Nozetek lab scale extruder Touch - Touch HT</td>
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<td>PMI porometer</td>
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<td>Roaches Padder</td>
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<td>Single beam spectrophotometer</td>
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<td>TAM III calorimeter system</td>
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<td>Thermal mechanical analyzer (TMA)</td>
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<td>Ultrasonic Spray System</td>
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<td>UV accelerated weathering tester</td>
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<td>Xenon Weatherometer</td>
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Section II
Polymer, Fiber and Textiles Capabilities
1. Dyeing, Finishing and Coating

Dyeing and durable functional surface coatings, e.g. Nanocellulose gel as multi-functional surface coatings.

PI: Prof. Suraj Sharma

- Fibers and Yarns
- Textiles
- Coating
- Coating and lamination materials
- Dyeing
- Surface treatment of textiles

Equipment

- APV Homogenizer 2000
- Baking Oven
- Dip-coater
- Dry-spinnin system
- Electro-spray and spinning system
- Freeze-dry system
- Laboratory Drying Condensation, and Fixation Apparatus
- Launderometer
- Macbeth Color Eye 7000A
- Mathis Dryer
- Roaches Padder
- Spin-coater
- Ultrasonic Spray System
- Vertical Laboratory Padder
- Xenon Weatherometer

Applications

- Apparel
- New coatings that impart functionality
- Technical Fabrics
- Textile Modification (dyeing, finishing and coating)
Nonwoven fabrication

Developing melt-blown nonwoven fabrics and carding process for technical application.
Principal Investigator: Prof. Gajanan S. Bhat.
3. Nano and Micro Fibers Manufacturing

New methods and facilities for nano-fiber manufacturing (magneto-, touch-, brush- and reactive spinning).
Principal Investigator: Prof. Sergiy Minko

Fibers and Yarns
- Fiber production
- Fiber, yarn, and fabric testing, standardization, and in-line inspection
- Thread manufacturing
- Yarn formation
- Yarn spinning

System Integration
- Fiber, yarn, and fabric testing
- Fiber & Yarn Testing - physical, mechanical and chemical properties

Equipment
- Bespoke Equipment
- Noztek lab scale extruder Touch - Touch HT
- Universal laboratory carding machine
- Wayne Machine & Die Co. Twin Screw Extruder

Applications
- Apparel
- Defense and military
- Medical & Healthcare
- Raw Materials
- Sports & fitness
- Technical Fabrics
- Work & Safety Wear

Available at: University of Georgia
Fiber-Yarn-Fabric Formation and Polymer Processing

Fibers and Yarns
- Fiber production
- Fiber, yarn, and fabric testing, standardization, and in-line inspection
- Preform Fabrication

System Integration
- Fiber, yarn, and fabric testing
- Fiber & Yarn Testing - physical, mechanical and chemical properties

Equipment
- Brothers home sewing machines
- Hand carding machine
- Hand Knitting Machine
- Juki baby lock serger
- Juki sewing machines
- Melt Compounder
- Noztek lab scale extruder Touch - Touch HT
- Resin transfer molding machine
- Shirley Analyser Mk2
- Table Loom
- Universal Laboratory carding
- Wayne Machine & Die Co. Twin Screw Extruder

Applications
- Apparel
- Raw Materials
Textile and Material Testing

Textile and material testing for end-use properties including physical, mechanical, chemical, thermal properties, etc.

PI: Prof. Suraj Sharma

Equipment

- Abrasion and pilling testers
- Airborne Particle Counter
- Altas Weather-ometer
- Automated Capillary Flow Porometer
- Automated micro porometer
- Bench top autoclave
- Biological safety hood
- Bispectral fluorescence colorimeter
- Bruker AFM Microscopes
- Compound polarizing and stereo zoom microscopes
- Differential scanning calorimeter (DSC)
- DLS particle size analyzer ZS Malvern
- Dynamic Mechanical Analysis system
- Fluorolog 3 spectrofluorometer
- GC/mass spectrophotometer
- Gravimetric absorbency testing system
- Hydrostatic pressure tester
- Incubation ovens
- Instron Tensile testers
- IR-spectrometer
- Macbeth ColorEye 7000A
- MCR 302 Modular Anton Paar (magneto-) rheometer
- Mettler Thermal analysis system
- Modular microcalorimetric systems TA Instruments
- Nanofilm ep-4 imaging ellipsometer
- Olympus optical microscope
- Oxygen index flammability testers
- Penetration tester
- PMI porometer
- Pneumatic and hydraulic bursting testers
- Research Magneto-Rheometer, Anton Paar
- Shimadzu Spectrofluorophotometer
- Shimadzu UV-Vis Recording Spectrophotometers
- Single beam spectrophotometer
- Snagging tester
- Spectrofluorometer
- TAM-III calorimeter system
- Tear testers
- Texttest Air Permeability testers
- Thermal gravimetric analyzer (TGA)
- Thermal mechanical analyzer (TMA)
- Tinius Olsen melt flow indexer
- UNITED tensile tester
- UV accelerated weathering tester
- UV-Vis spectrophotometer
- ZS Malvern dynamic light scattering particle analyzer

Applications

- Apparel
- Materials Testing
- Raw Materials
- Textiles Testing
6. **Smart Textile R&D**

Research and prototyping capabilities for smart textiles, e.g. energy harvesting textiles, vitamin A encapsulation in textiles, etc.

PI: Prof. Sharma

**Fibers and Yarns**

- Fiber production

**Textiles**

- Coating
- Surface treatment of textiles

**Equipment**

- Bespoke Touch Spinning Machine

**Applications**

- Apparel
- Medical & Healthcare
- Military uniforms
- New coatings that impart functionality
- Sports & fitness
- Technical Fabrics
- Textiles
Cooling fabrics

Available at: University of Georgia

Capacity: R&D

We have experiences in the development and testing of textile with thermal and moisture management capabilities.
PI: Prof. Suraj Sharma

Textiles

Coating and lamination materials

Equipment

- APV Homogenizer 2000
- Dip-coater
- Dry-spinning system
- Electro-spray and spinning system
- Freeze-dry system
- Guarded sweating hot plate
- Hand Knitting Machine SK280
- Laboratory Drying Condensation, and Fixation Apparatus
- Mathis Dryer
- Roaches Padder
- Spin-coater
- Ultrasonic Spray System
- Universal laboratory carding machine
- Vertical Laboratory Padder

Applications

- Apparel
- Construction Commercial & Residential
- Medical & Healthcare
- Sports & fitness
Section III
Product Development and Design Capabilities
1. 3D Design and Printing

3D Design and Printing

- Capacity: R&D, Pilot line for low rate production

We have 3D design and printing capabilities. A state of the art computer lab powered by Lectra software.

Principal Investigator: Prof. Suraj Sharma

- Design and Modeling
  - 3D-printing of preforms
  - Integrated fabric design automation
  - Modeling
  - Multi physics modeling
  - Product design

- Equipment
  - GEEETech/i3 3D Printer
  - Lectra Software Computer Lab

- Applications
  - Apparel
  - Textile
Product Development and Design Studio

We have a state of the art lab with Auto CAD and Lectra software, available for product development and textile design. Currently we have incorporated training in this lab for our students as part of the curriculum of Fashion Merchandising and Furnishing and Interiors.

Design and Modeling

- 3D Printing
- CAD design
- Modeling
- Product design

System Integration

- E-Textiles
Section IV
Academic and Extension Capabilities
1. **Community Support-Textile Related Issues**

Through the extension program, we reach out to the Georgia community and collaborate with our local agents to address issues related to textile products. We advise in topics such as textile care, quality and selection; and textile research and testing. [https://www.fcs.uga.edu/extension/textiles](https://www.fcs.uga.edu/extension/textiles)
2. Academic Programs in Textiles, Merchandising and Interior

Academic Programs in Textiles, Merchandising and Interior

Our expertise ranges from merchandising and interior design to polymer, fiber, and textile science. We offer a variety of experiential learning experiences including internships, education abroad, research, and service learning.

Contact information: Dr. Suraj Sharma, ssharma@uga.edu.

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3. **Historical Collection**

The Historic Clothing and Textile Collection is a study collection of over 3000 garments, accessories, and textiles dating from the 1800’s to now. It includes women’s, men’s, and children’s clothing and accessories as well as quilts and coverlets from the 19th century. UGA Special Collections.

**Textiles**

- Fabric weaving
- Finishing knit fabric

**Equipment**

- Conditioning Room
- Special Collection - Historic Items

**Applications**

- Accessories
- Apparel
- Textile
Thank You!