

NTC Research Briefs Introduction

The National Textile Center (NTC) is a research consortium of eight universities: [Auburn University \(Consumer Affairs, Engineering\)](#), [University of California at Davis](#), [Clemson University](#), [Cornell University](#), [Georgia Institute of Technology](#), [University of Massachusetts at Dartmouth](#), [North Carolina State University](#) and [Philadelphia University](#).

To view the full Research Brief of the work described in the highlight below, click on the project title. For further research details, see the project's website reported in this Research Brief, in the [2007 Annual Report](#), on the web at http://www.ntcresearch.org/current/FY2007/FY2007_proj.htm or on the latest CD. You can keyword search and view all NTC Reports ever published at <http://ntcresearch.org> and also view all reports on the CD.

To contact any principal investigator, see their bio following each Research Brief for their email address, phone, web-site address and NTC project numbers. Bios for all principal investigators who ever participated in an NTC project are continuously updated on the web at http://ntcresearch.org/PDF_BIO_index.htm and/or on the latest CD/ROM.

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NTC Research Briefs by Competency Groups

Materials

Research in the design, development and measurement of natural and synthetic polymeric materials and fibers, including polymer mixtures and additives.

Efficient Biological-Chemical Protective Materials

We are developing the fundamental knowledge to design "breathable" fabrics that also provide barrier protection from biological and chemical hazards. (Gowayed with Clemson) [M05-AE11]

Functional Fibers via Biomimesis

We are developing a fundamental understanding of how liquid wets and flows in nanoporous fibers and nanofibrous substrates. (Hsieh with Clemson, Natick) [M05-CD01]

New Cellulose Engineering Materials

We are developing a fundamental understanding of the cellulose dissolution process to create a new class of cellulose engineering materials. (Frey with NC State) [M05-CR02]

Shape Memory Polymer Fibers for Comfort Wear

We are using chemical and mechanical shape memory effects to develop fibers that change their shape in response to external stimuli, e.g. temperature, for enhanced fabric comfort. (Cook with NC State) [M05-GT14]

High Modulus Aliphatic Nylon Fibers via Lewis-Acid Complexation

By forming a Lewis acid - nylon 66 complex to reduce hydrogen bonding during drawing, we have produced high melting, ultra-high modulus and high strength fibers. (Kotek with Long Island U.) [M05-NS05]

Integrated Production of Functional Fibers and Nonwovens

We are developing processes to graft polymerize during reactive extrusion to yield self-decontaminating nonwoven barrier fabrics that protect against biological and chemical hazards. (Sun) [M06-CD04]

Fibers for Textile-Based Electrical Energy Storage

Our goal is to fabricate and test fiber-based capacitors suitable for storing electrical energy in multifunctional textile products. (Creager with Old Dominion) [M06-CL07]

Hierarchically Designed and Conductive Elastomeric Fibers

By engineering molecular conformations, we are developing elastomeric polymers and fibers with improved mechanical properties and tunable electrical conductivity. (Jacob with UMass Amherst) [M06-GT03]

Improving Textiles with Cyclodextrins

We are exploiting the tendency of cyclodextrins to form inclusion compounds with many small molecule additives and polymers to improve/enhance textile properties. (Tonelli with Georgia Tech) [M06-NS02]

Fabrication

Research in the fabrication, processing and manufacture of fibrous structures and fabricated products.

Reinforcement Fabrics with Electronic Transmission Capability

We are developing fundamental knowledge to understand how to design geotextile roadbed liners embedded with antennae and electronic transmission capability. (Thomas) [F05-AE13]

Demand Activated Toughening in Ballistic Protective Garments

To design comfortable, ballistic protective garments, we are developing an understanding of shock-induced chemical reactions that convert flexible polymers to hard ceramic materials. (Jacob) [F05-GT04]

Electrospun Bicomponent Fibers for Tissue Engineering

We are developing electrospun bi-component nanofiber structures, using biodegradable polymers for application as scaffolds for tissues engineering. (Gupta) [F05-NS04]

Scent-Infused Textiles to Enhance Consumer Experiences

We are developing polymer fibers that incorporate effective, long-lasting fragrances for innovative and marketable textiles and to measure their psychology of acceptance. (Pierce) [F05-PH03]

Direct Writing Biological Patterns & Constructs onto Fabrics

We are exploring the knowledge of direct writing biological patterns and constructs onto fabrics to create textile-based bio/medical microdevices. (Huang with RPI) [F06-CL02]

Nanolayer Self-assemblies: Novel, Adaptable Fiber Surfaces

Nanolayers, nanoparticles or thin films when deposited on textile substrates impart value-added properties without compromising fabric comfort or mechanical properties. (Hinestroza with NC State) [F06-CR02]

Ultra-fine Filament Yarns Made by Supersonic Jet Splitting

We are developing the fundamental understanding to lead to a new approach towards cost-effective production of ultra-fine continuous filament yarns. (Yao) [F06-GT01]

Piezoelectric Fabrics for Energy Harvesting

Piezoelectric fabrics are ideally suited to power wearable electronics, an application where bulky batteries are very impractical. (Guillot) [F06-GT05]

Transport in 3-D Nanofab Geometries

We are developing experimental and numerical fluid transport models for 3D nanofabricated devices. (Bhowmick with Natick)[F06-MD04]

Formation and Performance of Auxetic Textiles

We have combined our knowledge of geometry and fabric structural characteristics to produce auxetic knit structures from non-auxetic yarns. (Ugbolue) [F06-MD09]

Blue-Cured Adhesives for Bonding and 3-D Medical Textiles

We are exploring the use of blue light instead of UV to rapidly cure bonding resins and to build 3-D fabric structures for biomedical uses, such as tissue engineering. (Calvert with UMass Lowell) [F06-MD14]

Environmental Fabrics and Breathing Wall Systems

We are developing fabric and modular wall assemblies to retrofit existing buildings to combat Sick Building Syndrome and will be developing multiple skins structures. (Messinger) [F06-PH03]

Chemistry

Research in chemical applications to, and modifications of, fibers and fiber substrates, including dyeing, finishing and waste reduction.

Molten Organic Salts as Solvents for Fiber Extrusion

We are investigating using molten organic salts as solvents for the extrusion of stiff and/or polar materials, including cellulose. (Broughton with U. of Alabama) [C05-AE05]

Textiles with Highly Selective Receptors for Specific Molecules

By molecular imprinting polymers on fibers, we are designing novel functionalities with molecular recognition capability for molecular separation, isolation, immobilization and sensing applications. (Luzinov) [C05-CL01]

Antimicrobial Membranes for Protective Clothing

Antimicrobial membranes for protective clothing kill bacteria upon contact. (Obendorf with UC Davis) [C05-CR01]

High-Yield Application of Permanent Colorants

We are incorporating ionic functional groups into textile colorants and finishes to increase add-on and then permanency via subsequent *in situ*, thermally-induced, covalent bond formation. (Beckham) [C05-GT04]

Inkjet Deposition of Complex Mixtures to Textiles

We are developing a fundamental understanding of the process of deposition of complex mixtures. (Carr with CCNY) [C05-GT07]

Boundary Lubrication and Molecular Assembly

We are elucidating the structural characteristics of the boundary layer adsorbed on fiber surfaces that controls wear and friction during textile processing. (Rojas with Cornell, UC Santa Barbara) [C05-NS09]

Self-Decontaminating Textiles

We are developing chemical systems that will prevent/remove toxic contaminants from textile fabrics and surfaces. (Slaten with UC-Davis) [C06-AC01]

Effect of Silicone Finishes on the Burning Behavior of PET

To mitigate adverse silicone interactions, we are developing fundamental understanding of the impact of siloxanes on the burning behavior of polyester fibrous structures. (Drews with U of Georgia) [C06-CL01]

Hydrodynamic Lubrication in Fiber Processing

We are expanding our fundamental understanding of the mechanisms of hydrodynamic fiber lubrication to aid in the development of future generations of fibers and fiber lubricants. (Krause) [C06-NS07]

Systems

Research in the management of product design, sourcing, production, distribution and consumption systems.

Masculine Fashion Choices: Shifting Identities

We aim to understand how the shifting male consumer culture thinks about fashion and lifestyle issues and how men evaluate and purchase clothing. (Solomon with Berry, UC Davis, Delaware, Cornell) [S05-AC02]

Fabric/Skin Interactions: Contact, Friction and Dynamic Motion

We are developing multi-scale models of physical and physiological interactions between fabric and skin, such as contact and friction, and the impact of dynamic motion (e.g. walking). (Pan with UCSF) [S05-CD04]

Hispanic Characterization System

This is the first comprehensive, empirical research system designed to generate a multidimensional profile of the U. S. Hispanic market in terms of textile and apparel needs and preferences. (Jones) [S05-NS04]

Strategic Sustainability and the Triple Bottom Line

We are examining how sustainability practices in the apparel-textile complex relate to economic, social and environmental goals in apparel, furnishings and artificial turf. (Solomon with Berry College) [S06-AC01]

Apparel Product Development for Plus-sized Tween & Teen Boys

We are investigating the physical and social-psychological dimensions of demand for apparel by tween boys (aged 9-14), particularly those who are overweight and obese. (Connell with [TC]²) [S06-AC03]

Visual Approach to Assessing Apparel Brand Personalities

We are developing a visual lexicon of brand personality that links apparel brands with the meanings a standardized set of images evoke for improved market positioning. (Solomon with Berry) [S06-AC04]

Research Network on Multifunctional Protective Clothing

We are forming a group of researchers and manufacturers to focus on multifunctional protective clothing and materials for firefighters, paramedics and police officers. (Sun with Auburn, Cornell) [S06-CD01]

Dynamic Textile Process and Quality Control Systems

This Dynamic Quality/Process Control System utilizes all structural equations known to date to design an effective, dynamically responsive system. (Suh) [S06-NS02]

Guide to NTC Project Numbers (XNN-YYnns) where ...

X = first letter of the competency

NN = last two numbers of the NTC fiscal year (May to April) when the project was first funded

YY = university:

AC = Auburn Consumer Affairs (was A)

AE = Auburn Textile Engineering (was A)

CL = Clemson (was C)

CD = U Cal-Davis (was E)

CR = Cornell (was B)

GT = Georgia Tech (was G)

MD = U Mass Dartmouth (was D)

PH = Philadelphia U. (was P)

NS = North Carolina State (was S)

nn = number assigned by university to project

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NTC Directory

Principal Investigators, Operating Board, Site Directors, Staff:

- **Bios, Photos, E-mail, etc.** . see http://ntcresearch.org/PDF_BIO_index.htm

Biographies for everyone who has ever been an NTC principal investigator include title, institution, academic degrees, experience, research interests, E-mail address, telephone number, personal web site address and all NTC projects they worked on.

NTC Research Briefs by Project Management

Auburn University (Consumer Affairs) Management

Masculine Style(s): Shifting Identities and Textile/Apparel

(Kwon with Berry College, UC Davis, Univ. Delaware, Cornell) S05-AC02

Self-Decontaminating Textiles (Slaten)..... C06-AC01

Strategic Sustainability and the Triple Bottom Line

(Kwon with Berry College) S06-AC01

Apparel Product Development for Plus-sized Tween & Teen Boys

(Connell with [TC]²) S06-AC03

Visual Approach to Assessing Apparel Brand Personalities

(Kwon with Berry) S06-AC04

Auburn University (Engineering) Management

Investigation of Organic Ionic Liquids for Fiber Extrusion

(Broughton with U. of Alabama) C05-AE05

Reinforcement Fabrics with Electronic Transmission Capabilities

(Thomas) F05-AE13

Efficient Biological-Chemical Protective Materials (Gowayed with Clemson) M05-AE11

University of California at Davis Management

<u>Functional Fibers via Biomimesis</u> (Hsieh with Clemson, Natick)	M05-CD01
<u>Fabric and Skin: Contact, Friction and Interactions</u> (Pan with UC San Francisco)	S05-CD04
<u>Integrated Production of Functional Fibers and Nonwovens</u> (Sun)	M06-CD04
<u>Research Network on Multifunctional Protective Clothing</u> (Sun with Auburn, Cornell, NC State)	S06-CD01

Molecularly Imprinted Fibers with Recognition Capability (Luzinov) C05-CL01
Effect of Silicone Finishes on the Burning Behavior of PET
(Drews with U of Georgia) C06-CL01
Direct Writing Biological Patterns & Constructs onto Fabrics
(Huang with Naval Research) F06-CL02
Fibers for Textile-Based Electrical Energy Storage
(Creager with Old Dominion) M06-CL07

Cornell University Management

Microporous Membranes Intended for Protective Clothing

(Obendorf with UC Davis)..... C05-CR01

Creation of a New Class of Cellulose Engineering Materials

(Frey with NC State) M05-CR02

Nanolayer Self-assemblies: Novel, Adaptable Fiber Surfaces

(Hinestroza with NC State) F06-CR02

Georgia Institute of Technology Management

<u>Novel, High-Yield Application of Permanent Colorants</u> (Beckham)	C05-GT04
<u>Inkjet Deposition of Complex Mixtures to Textiles</u> (Carr with CCNY)	C05-GT07
<u>Demand Activated Toughening in Garments</u> (Jacob)	F05-GT04
<u>Shape Memory Polymer Fibers for Comfort Wear</u> (Cook with NC State)	M05-GT14
<u>Ultra-fine Filament Yarns Made by Supersonic Jet Splitting</u> (Yao)	F06-GT01
<u>Piezoelectric Fabrics for Energy Harvesting</u> (Guillot)	F06-GT05
<u>Hierarchically Designed and Conductive Elastomeric Fibers</u> (Jacob with UMass Amherst)	M06-GT03

University of Massachusetts at Dartmouth Management

<u>Transport in 3-D Nanofab Geometries</u> (Bhowmick with Natick)	F06-MD04
<u>Formation and Performance of Auxetic Textiles</u> (Ugbolue)	F06-MD09
<u>Blue-Cured Adhesives for Bonding and 3D Medical Textiles</u> (Calvert with UMass Lowell)	F06-MD14

Boundary Lubrication and Molecular Assembly in Fiber
(Rojas with Cornell, UC Santa Barbara)..... C05-NS09

Electrospun Core-Sheath Fibers for Soft Tissue Engineering (Gupta) ... F05-NS04

High Modulus Aliphatic Nylon Fibers via Lewis-Acid Complexation
(Kotek with Long Island U).....M05-NS05

Hispanic Characterization System (HCS) (Jones) S05-NS04

Improving Textiles with Cyclodextrins (Tonelli with Georgia Tech) M06-NS02

Hydrodynamic Lubrication in Fiber Processing (Krause) C06-NS07

Dynamic Textile Process and Quality Control Systems (Suh) S06-NS02

Scent-Infused Textiles to Enhance Consumer Experiences (Pierce)..... F05-PH03

Environmental Fabrics and Breathing Wall Systems (Messinger) F06-PH03

Abbreviations

The following abbreviations are not always defined in articles.

Auburn (AE, AC): University of Auburn, Auburn AL 36849 [E=TE;C=Consumer]	MAE: Mechanical and Aerospace Engineering	TFE: Textile and Fiber Engineering
Chem Eng: Chemical Engineering	ME: Mechanical Engineering	TFPS: Textile, Fiber & Polymer Science
CivE: Civil Engineering	M.I.T.: Mass. Inst. of Technology	TRI: Textile Research Institute (Princeton NJ 08542)
Clemson (CL): Clemson University, Clemson SC 29634	NC State (NS): North Carolina State University, Raleigh NC 27695	UAB: Univ. of Alabama-Birmingham
Cornell (CR): Cornell University, Ithaca NY 14853	NMR: nuclear magnetic resonance	UC-Davis (CD): University of California – Davis, Davis CA 95616-8722
dpf: denier per filament	PET: poly(ethylene terephthalate)	UD: University of Delaware
DSC: differential scanning calorimetry	PhilaU (PH): Philadelphia University, Philadelphia PA 19144	UG: University of Georgia
ESR: electron spin resonance	Poly Sci: Polymer Science	UNC-G: University of North Carolina at Greenville
Fib: Fiber	RPI: Rensselaer Polytechnic Institute	UMassD (D): University of Massachusetts at Dartmouth MA 02747
FTIR: Fourier Transform Infrared	SEM: scanning electron microscopy	UNL: University of Nebraska at Lincoln
Georgia Tech (GT): Georgia Institute of Technology, Atlanta GA 30332	TAM: Textile and Apparel Management [TC] ² :Textile/Clothing Technology Corp	UNO: University of New Orleans
LSU: Louisiana State University	TE: Textile Engineering	U of PA: University of Pennsylvania
	TEM: transmission electron microscopy	U of Tenn: University of Tennessee
	Tex: Textile	URI: Univ. of Rhode Island
	TextE: Textile Engineering	

Discontinued Projects

[ordered by University, then competency, then year]

The following NTC projects were discontinued because they successfully completed their maximum three-year life span (or one-year for seed projects) or because other research was of higher priority. For their last Annual Report, click on the project title below or see the NTC website at <http://www.ntcresearch.org>, or the Table of Contents for the [June 2007 NTC Research Briefs](#) or the [November 2007 NTC Annual Report](#). You may also contact the principal investigators whose phone numbers and E-mail addresses are listed therein. New projects often grew out of completed projects (See the notes following the listings below for any new projects).

<u>Ultrahydrophobic Fibers: Lotus Approach</u> (Luzinov with Clarkson).....	C04-CL06
<u>Ionic Crosslinking - A Novel Method of Fabric Stabilization</u> (Smith).....	C04-NS01
<u>Static Generation and Control in Textile Systems</u> (Seyam with Western Ontario)	C04-NS07
<u>Optimizing Color Control Throughout the Textile Supply Chain</u> (Hinks with Clemson).....	C04-NS11
<u>Genetic Algorithms in Molecular Design of Novel Fibers</u> (Sztandera with Cornell, Oxford)	C05-PH01
<u>Coated and Laminated Fabrics for Fuel Cells</u> (Adanur with UMassD)	F04-AE01
<u>Fibrous Micro-Electro-Mechanical-Systems (MEMS)</u> (Netravali).....	F04-CR02
<u>Frequency Effect on Drawing Behavior of Staple Fiber Strands</u> (Wang with UC Davis)	F04-GT01
<u>Analysis of the Superdraw Process of Hollow Fibers</u> (Wang with East Carolina U.)	F04-GT02
<u>Micro-Flow in Textiles</u> (Leisen with Niederrhein Univ.).....	F04-GT05
<u>Compact Fiber-Based Bioconversion/Bio-filtration Systems</u> (Kim)	F04-MD11
<u>Fracture Toughness of Through-Thickness Reinforced Composites</u> (Rice).....	F04-MD12
<u>Printing Electric Circuits Onto Non-Woven Conformal Fabric</u> <u>Substrates</u> (Pourdeyhimi)	F04-NS17
<u>Single-step Protein Surface-attachment to Electrospun Fibers</u> (Spontak with Max Plank).....	F04-NS26
<u>Cost-Effective NanoFiber Formation - Melt Electrospinning</u> (Warner with NJIT)	F05-MD01
<u>Direct Spinning and Fabrication: The Robospider</u> (Calvert)	F05-MD09
<u>Liquid Wetting and Flow in Nano-Fibrous Systems: Multi-scale and</u> <u>Heterogeneous</u> (Hsieh with TRI).....	M04-CD01
<u>Distributed Sensors and Actuators via Electronic-Textiles</u> (Jalili)	M04-CL05
<u>Poly(lactic acid) Derived Fibers with Enhanced Performance</u> (Smith with Long Island U).....	M04-CL07
<u>Surface Modification of CSM Fibers Using Branched Additives</u> (Hirt with U of Florida).....	M04-CL11

<u>Cellular Encapsulation into Porous Alginate Fibers</u> (Brown with U of Rhode Island).....	M04-CL13
<u>Nano Scale Polymerization and Fiber Spinning</u> (Jacob with Ohio St)	M04-GT11
<u>Textile Fibers Engineered From Molecular Auxetic Polymers</u> (Griffin)	M04-GT21
<u>Quantum Tunneling Nanocomposite Textile Soft Structure Sensors and Actuators</u> (Patra).....	M04-MD07
<u>Integrated Production of Functional Fibers and Nonwovens</u> (Sun)	M06-CD04
<u>Textile Based Carbon Nanostructured Flexible Antenna</u> (Patra with RPI) ..	M06-MD01
<u>Apparel Product Development for the Plus-Sized Tween and Teen Market</u> (Connell with [TC] ²)	S04-AC01
<u>Effects of Textile Floor Coverings on Posture Steadiness and Locomotion Stability</u> (Pan).....	S04-CD03
<u>Improved Apparel Sizing: Fit and Anthropometric 3D Scan Data</u> (Ashdown with UC Davis).....	S04-CR01
<u>Quantifying the Value of Information in a Supply Chain</u> (King).....	S04-NS02