NTC Research Briefs Introduction

To view the full Research Brief of the work described in the highlight below, click on the project number. For further research details, see the project's website reported in this Research Brief, in the 2002 Annual Report, on the web at http://www.ntcresearch.org/current/year12_FY2003/yr12_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.

Intelligent Textiles with Environmentally Responsive Fibers

We are designing "smart" textiles that sense and actively self-regulate their immediate environmental surroundings through the electro-active response of fibers. (Foulger) [M00-CL07]

Bio-Active Fabrics

We are developing fabrics that contain genetically engineered cells that will enable them to generate and replenish chemical coatings and chemically active components. (Fowler) [M00-MD03]

Nanocomposite Fibers

We are developing biphasic fibers intimately blended with nanosized rigid particles, such as clay, silica, graphite and carbon nanotubes, to produce vastly enhanced fiber properties. (Kim) [M00-MD08]

Fluoropolymer Optical Fibers, Fiber Amplifiers, Lasers for “Smart” Textiles

We are developing fluoropolymer optical fibers, fiber amplifiers and lasers that enable the reliable reception, routing and secured broadcasting of information for use in “smart” textiles. (Ballato) [M01-CL01]

Surface Modification of Fibers with Hybrid Polymer Nanolayers

We are developing ways to create multifunctional responsive/adaptive "smart" fibers by modifying their surface with hybrid polymer nanolayers. (Luzinov) [M01-CL03]

Dynamic Chameleon Fiber Systems

We are designing fibers that can quickly change their color, hue, depth of shade or optical transparency by application of an electrical or magnetic field. (Gregory) [M01-CL07]

Biodegradable Hydrogel-Textile Hybrid for Tissue Engineering

Using biodegradable hydrogel technologies and non-woven fabrics, we are developing textile-based scaffold biomaterials for engineering new tissues and organs for human body repair. (Chu) [M01-CR01]

Predicting Chemical Penetration Through Nonwoven Protective Clothing

Using a synthetic membrane system as an appropriate model for human skin, we found that textile absorbency greatly reduces transport of pesticide from contaminated clothing through skin. (Obendorf) [M01-CR02]

High Modulus, High Tenacity Melt Spun Fibers

We are developing techniques to describe the morphology of high tenacity/high modulus fibers to levels not previously possible. (Michielsen) [M01-GT01]

Fiber Structure Evolution During Spinning

We are investigating strain induced morphology development in fibers to understand the evolution of structure during the fiber formation process. (Jacob) [M01-GT04]

Electrostatic Spinning and Properties of Ultrafine Fibers

We are developing the fundamental understanding of electrospinning and the technology to controllably produce <0.1µ diameter electrospun fibers. (Rutledge) [M01-MD22]

High Strength Polyamides by Suppressing Hydrogen Bonding

By suppressing interchain amide group hydrogen bonding during spinning and drawing, we hope to develop ways to produce nylon fibers with higher strength and modulus. (Kotek) [M01-NS03]

Transport in Fibrous Substrates: Liquid and Solid Interactions

From microscopic liquid and solid interactions, we are developing stochastic models to predict liquid transport behavior in fibrous substrates. (Pan with Cornell) [M02-CD03]

Immobilization of Biomolecules on Fibers

We are developing processes to chemically activate the surface of fibrous materials for the recovery of biomolecules, such as specialty enzymes, by encapsulation/immobolization. (Hsieh with Natick) [M02-CD05]

Biomimetic Manufacturing of Fibers: Materials Development

We are exploiting recombinant DNA and plant transgenic technologies to create and produce novel protein polymers in significant quantities for fiber spinning. (Ellison) [M02-CL04]

Photonic Crystal-Based Optical Fibers with Active Tunability

We are developing ways to produce polymeric, photonic crystal-based, optical fibers that exhibit extremely low-loss light transmission for communications and sensing applications. (Brown) [M02-CL06]

Nano Engineered Fire Resistant Composite Fibers

We are developing a fundamental understanding of the thermal insulation of heat and fire resistant polymeric composite fibers when embedded with nanoparticle fillers. (Patra with Auburn) [M02-MD08]

Polymers Processed with Cyclodextrin Inclusion Compounds

We are developing a fundamental understanding of how cyclodextrin inclusion compounds deliver properties, such as flame retardancy, antibacterial, color, etc., to polymers during processing. (Tonelli) [M02-NS01]

Fabrication

Research in the design, development, manufacture and measurement of fiber products, including process control.

Substrate-Coating Interaction in Coated Fabrics

We are developing models to predict interactions between a deforming fiber and its coating to optimize structural configurations of coated fabrics under complex loading conditions. (Chen) [F00-MD06]

Architectural Fabric Structures

(Messinger) [F00-PH01]

Report Not Submitted

Engineering Non-Linear Elastic Blended Fabrics

Experimental values of elastic axial tensile recovery of hybrid braided fabrics, such as used for athletic wear and biomimetic devices, are in good agreement with our theoretical model. (Pastore) [F00-PH05]

Magnetic Ring-Spinning for Increased Speeds

By replacing the traveler in ring spinning with a disc that rotates in a magnetic field, we hope to maintain the high quality of ring spun yarn, but at much higher speeds. (Abdel-Hady) [F01-AE02]

Nonlinear Dynamics of High Speed Transport in Non-Uniform Yarns

We are re-examining and seeking experimental validation of some of the time-honored assumptions in the equations describing unwinding. (Goswami) [F01-CL04]

"Green" Composites from Cellulose Fabrics & Soy Protein Resin

Using short and continuous plant-based fibers and soy protein polymer, we have developed fully degradable composites with sufficient mechanical properties. (Netravali) [F01-CR01]

One Step Carding-Spinning

We are developing the knowledge base that can lead to better carding and spinning processes, and fewer steps to convert fiber into yarn. (Wang) [F01-GT06]

Micromachines in Fabric Formation

We are developing mechanisms that combine micro-electro-mechanical systems (MEMS) and robotic devices to automatically repair broken warp ends, thus leading to fully automated weaving. (Seyam) [F01-NS14]

Modeling Thermal Protection of Apparel

We are developing a model to predict heat and moisture transport in firefighter protective clothing during flash fire exposures. (Barker) [F01-NS50]

Compressive Behavior of Fiber Assemblies

We are characterizing compressive behavior of fiber assemblies (e.g. carpets, nonwovens, pillows) with modeling and experimental techniques. (Jacob) [F02-GT04]

Layered Fiber-based Microtubes

We are exploring the technological potential of submicron diameter tubing of electroactive polymeric materials for applications in sensing and actuation. (Ghosh) [F02-NS05]

Virtual 3D Draping of Apparel

We are developing methods for an accurate, virtual 3-D draping of apparel on a digitized model of the human body considering variations in fabric mechanical properties. (May-Plumlee with TC^2) [F02-NS08]

Chemistry

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

Abrasion Resistance of Durable Press Cotton

We are developing a fundamental understanding for the loss of abrasion resistance in durable press cotton fabric. (Lickfield) [C00-CL01]

Quantum Dots as Dyes and Optical Brighteners for Fibers

We are varying the size of semiconductor nanocrystals to color fibers over the entire visible range of the electromagnetic spectrum. (Srinivasarao) [C00-GT03]

Rapid Design of Novel Chemicals for Textiles

We are integrating combinatorial organic synthesis, high throughput screening and chemoinformatics to develop novel chemicals for the textile industry. (Bhat) [C00-PH01]

Using Dense Gas Fluids to Improve Chemical Processing

We are using dense gas fluids, such as CO_2, to improve selectivity, reaction rate and control in durable finishing, morphology modification and coloration processes for fibers. (Drews) [C01-CL01]

Dyeable Polypropylene via Nanotechnology

We are infusing nanoparticles, such as nanoclays modified with quaternary ammonium salt, into polypropylene fibers to create dyesites for lower cost dyeings in apparel fibers. (Fan) [C01-MD20]

Thermally Stable Textile Processing Aids

We are developing a methodology that will enable us to predict and improve the thermal stability of textile processing aids. (Grant) [C01-NS08]

Biomimicking of Enzymes for Textile Processing

We are developing ways to replace enzyme biocatalysts with simpler compounds that mimic their behavior, yet increase reaction rate, facilitate the enzymatic process and decrease cost. (Buschle-Diller) [C02-AE02]

Pressure Washing of Textiles to Save Water and Effluent

We are studying the feasibility of using continuous, pulsed and aerated pressure washing of fabrics as a way to significantly reduce rinse water and effluent. (Gowayed)[C02-AE08]

Textiles that Protect Wearers from Biological and Chemical Hazards

We are developing radical grafting polymerization as a way to provide disinfecting and detoxifying agents to textile surfaces, particularly for self-decontaminating protective clothing. (Sun with Auburn) [C02-CD06]

Textile Ink Jet: Drop Formation and Surface Interaction

We are studying the fundamental mechanisms of drop formation and drop/surface interaction in the regimes characteristic of textile ink jet printing. (Carr with IPST) [C02-GT07]

Biomimetic Decolorization of Mill Effluent

We are building nanofactories from grafted porphyrin-based catalysts and singlet oxygen chemistries to destroy organic material, such as dyes, in textile and carpet mill effluent. (Michielson with Emory) [C02-GT09]

One-Step Fabric Formation and Coloration

We are using cyclodextrins that function simultaneously as warp sizes and latent colorants to combine the weaving and the ink jet printing steps. (George) [C02-PH03]

Management Systems

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

Fabric Design and Analysis System in 3-D Virtual Reality

We are developing a 3D virtual reality fabric design system whereby yarn structural parameters are used to realistically model a fabric's structure and predict its performance before it is made. (Adanur) [S00-AE06]

Automated Garment Development from Body Scan Data

We are creating a conceptual model to automatically integrate body scanning data into commercial CAD/CAM software to facilitate garment design, derivation and sizing. (Carrere) [S00-NS15]

Haptic Simulation of Fabric Hand

We are developing a virtual reality system that allows users to achieve a virtual sense of touch so they can evaluate a fabric's hand without actually touching it. (Govindaraj) [S00-PH08]

Web-Based System to Track How Consumers Express Lifestyles

We are researching how consumer constellation theory allows consumers to jointly express desired lifestyles across product categories, such as apparel and home furnishings. (Solomon) [S01-AC21]

Redefining the Apparel Consumer

We are developing a stable, precise and relevant measure of consumer types based solely on how they acquire and use clothing and independent of demographics. (Brannon) [S01-AC25]

Virtual Fit Models Via Body Scan Analysis

By understanding body scan data, we seek to develop virtual fit models and slopers for mass produced apparel based on body shape, posture and weight distribution. (Connell) [S01-AC27]

Design-Oriented Fabric Comfort Model

We are developing a "virtual intimacy" measurement of fabric comfort using structural, fuzzy-logic and psychological modeling to replace the traditional intimacy of touch. (El Mogahzy) [S01-AE32]

Using Body Scan Data to Improve Garment Fit

We are providing insights into body/apparel relationships with the ultimate goal of developing a tool for apparel companies to improve their sizing systems. (Ashdown) [S01-CR01]

Business-to- Business (B2B) Collaboration in a Softgoods E-Supply Chain

We are providing models and prototype tools to support collaborative efforts in the business-to-business (B2B) environment. (King) [S01-NS01]

Emerging Apparel Supply Chain Configurations

We are developing a model that not only can optimally schedule a process, but link the apparel production processes together and form a supply chain with distinct operating characteristics. (King) [S01-NS10]

3-D Imaging of Fabrics from On-Line Yarn Data

We are developing a control system for electronically imaging the quality attributes of fabric directly from on-line yarn data. (Suh) [S01-NS12]

On-Line Weight and Shrinkage Control of Cotton Knits

To improve dimensional control during knitting, we are using image technology to design a system that measures the spatial characteristics of a knitted loop before and after relaxation. (Abou-iiana) [S01-PH07]

Fuzzy Forecasting Model for Apparel Sales

We are developing models to forecast apparel sales based on fuzzy logic, and shall then use those models to develop a comprehensive forecasting software package. (Frank) [S01-PH10]

Optimal Investment Strategies for Enhanced Productivity

To increase our textile industry's market share, we are defining investment strategies that maximize manufacturing productivity while satisfying dynamic consumer needs. (Christoffersen) [S01-PH13]

Modeling Consumer Behavior in On-line Environments

We are developing a model to predict on-line adoption of consumer search and purchase behaviors for textile and apparel products. (Forsythe) [S02-AC23]

Strategic Model for Functional Protective Clothing

We are developing a model, based on existing technologies, that optimizes multi-protective functions in professional uniforms for firefighters, police, military, medical workers, etc. (Sun) [S02-CD01]

Optimizing the Textile Complex Value Chain

By measuring buyer and seller perceptions of value of competing purchase options from country to country, we are developing value chain models for the textiles complex. (Rucker) [S02-CD02]

Sensory Science: Interactions in Textile Evaluation

We are developing a fundamental understanding of the social, cultural and physical factors that interact to shape human sensory responses to textiles. (Kaiser with U of Delaware) [S02-CD04]

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, 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
s (if present) = seed project

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NTC Research Briefs by Project Management

Auburn University (Consumer Affairs) Management

Auburn University (Engineering) Management

University of California at Davis Management

Clemson University Management

Cornell University Management

Georgia Institute of Technology Management

University of Massachusetts at Dartmouth Management

North Carolina State University Management

Philadelphia University Management

Abbreviations

The following abbreviations are not always defined in articles.

Auburn (AE, AC): University of Auburn, Auburn AL 36849 [E=TE;C=Consumer]
Chem Eng: Chemical Engineering
CivE: Civil Engineering
Clemson (CL): Clemson University, Clemson SC 29634
Cornell (CR): Cornell University, Ithica NY 14853
dpf: denier per filament
ESR: electron spin resonance
Fib: Fiber
FTIR: Fourier Transform Infrared
Georgia Tech (GT): Georgia Institute of Technology, Atlanta GA 30332
IPST or InstPaperSci&Tech: Institute of Paper Science &Technology
ITT: Institute of Textile Technology, Charlottesville VA 22903-4614
LSU: Louisiana State University
MAE: Mechanical and Aerospace Engineering
ME: Mechanical Engineering
M.I.T.: Mass. Inst. of Technology
NC State (NS): North Carolina State University, Raleigh NC 27695
NMR: nuclear magnetic resonance
PET: poly(ethylene terephthalate)
PhiladelphiaU (PH): Philadelphia University, Philadelphia PA 19144
Poly Sci: Polymer Science
TAM: Textile and Apparel Management
$[TC]^2$:Textile/Clothing Technology Corp
TE: Textile Engineering
Tex: Textile
TexE: Textile Engineering
TFE: Textile and Fiber Engineering
TFPS: Textile, Fiber & Polymer Science
TRI: Textile Research Institute (Princeton NJ 08542)
UAB: Univ. of Alabama-Birmingham
UC-Davis (CD): University of California – Davis, Davis CA 95616-8722
UD: University of Delaware
UG: University of Georgia
UNC-G: University of North Carolina at Greenville
UMassD (D): University of Massachusetts at Dartmouth MA 02747
UNL: University of Nebraska at Lincoln
UNO: University of New Orleans
UofPA: University of Pennsylvania
U of Tenn: University of Tennessee
URI: Univ. of Rhode Island

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 report, see the NTC website at **http://www.ntcresearch.org**, the June 2002 ***NTC Research Briefs*** or the November 2002 ***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).