A New Spin on Laundry Day

AATCC’s 2015 International Conference

Influence of Seam Type and Laundering on Seam Puckering and Functional Properties of Cotton/Polyester Shirt Fabrics
Yes, they both meet the new version of ISO 105-B02.

- Full range of optical filters for all major standards including ISO 105-B02, AATCC TM16, TM111, TM169, etc.
- Air-cooled for low operating costs and less maintenance
- Affordable, accurate and remarkably easy to operate
- Renowned Q-Lab reliability
- Rotating Drum and Flat-array designs available
- Simple calibration

Q-SUN

Xe-2 and Xe-3 xenon arc test chambers

www.q-lab.com/AATCC
Features

34 A New Spin on Laundry Day
By Glenna B. Musante

Within the last decade, new laundry machines, and new detergents for both commercial and residential machines, have emerged to meet energy efficiency mandates. How do these changes affect the fabrics being laundered?

Technology

41 Influence of Seam Type and Laundering on Seam Puckering and Functional Properties of Cotton/Polyester Shirt Fabrics
By Emilija Toshikj, Goran Demboski, Igor Jordanov, and Biljana Mangovska

Evaluation of seam pucker is one of the most important aspects for quality control in the shirt manufacturing industry. In the lifetime of a dress shirt, both fabrics and seams undergo repeated laundering, which may affect the quality and performance of the sewn dress shirt. Seam type and laundering significantly affected seam puckering, irrespective of detergent type.
Cotton has a proven track record as the fabric of our lives. Consumers have come to rely on it as a natural, comfortable, fashionable necessity. In fact, research tells us that more than half of all consumers would be dissatisfied if cotton were taken out of their favorite clothing. But cotton’s strengths go far beyond textiles. Cotton is food as well. Cottonseed oil is already in many of the foods we consume, and soon cotton’s protein-packed seeds will help feed the world’s growing population.

In addition to providing clothing and food, cotton can also be used to create biodiesel fuel. Cotton is so much more than a fiber. It’s a true miracle of nature.

Learn more at cottoninc.com.

Reviewed by Peter Hauser

Roshan Paul, the editor of *Functional Finishes for Textiles*, has collected an impressive array of contributions from textile experts in fourteen different countries. Following an overview chapter, the next eighteen chapters are grouped into two areas: finishes that improve textile comfort and performance, and finishes that provide protection to the wearer and the textile. Each well-referenced chapter describes the function of the finish, and the mechanism and chemistry behind the finish, as well as methods of application and evaluation. Future trends and environmental concerns are also considered for each finish. A final chapter addresses legal and safety issues that arise from the use of textile finishes.

The comfort and performance group includes finishes that provide thermal regulation, moisture management, soil release, fabric softness, enzymatic biofinishing for synthetic fibers, wool shrink resistance, cellulose easy care properties, fabric self-cleaning, superabsorbency, and a chapter on medical, cosmetic, and odor resistant finishes.

Finishes discussed in the protection group include insect repellent, antimicrobial, water and oil repellents, flame retardant, ultraviolet protective, radiation protective, antistatic, and biological, chemical, and ballistic protective finishes.

The chapters provide comprehensive literature reviews for each finish as well as discussing current chemistries and possible future developments, making the book valuable to both academic and industrial textile chemists. Of particular note is the inclusion of the relatively new sol-gel technique that finds application in multiple functional finishes (self-cleaning, antimicrobial, flame retardant, ultraviolet protective, water and oil repellent, insect repellent, and biological and chemical protective).

*Functional Finishes for Textiles* will be useful to all textile chemists as both a reference and a tool for new product development.

Review Author

Past AATCC President Peter J. Hauser is professor and interim head of the department of Textile Engineering, Chemistry, and Science at the College of Textiles in North Carolina State University. Hauser’s research areas include nanosciences, surface modification, fibers and polymers, color and dye chemistry and sciences, and energy, environment, and sustainability in textiles. He is the author of more than 83 peer reviewed research papers, more than five books or book chapters, more than eight US patents, and numerous technical articles and conference proceedings.

Peter J. Hauser, North Carolina State University, peter_hauser@ncsu.edu, www.tx.ncsu.edu

Book

*Functional Finishes for Textiles*, 1st Edition, edited by Roshan Paul, Woodhead Publishing, October 2014. Roshan Paul is the Head of European Research of the Department of Function and Care at the Hohenstein Institute in Germany. He is also a Chartered Colourist and a Fellow of the Society of Dyers and Colourists, and a Senior Life Member of AATCC.

Roshan Paul, Hohenstein Institute, paulrosh@yahoo.com

AVITERA® SE
Award-Winning Revolutionary Polyreactive Dyes

2014 ICIS Innovation Awards
Overall Winner: Winner of the new innovation with Best Benefit to Environment or Sustainability Award

2013 Environmental Leader Technology Reviews
5-stars rating for Excellence in Technology & Innovation

A revolutionary innovative flagship range of polyreactive dyes from Huntsman Textile Effects, AVITERA® SE delivers dramatic environmental and sustainability benefits with top-quality results.

Now available in a wider range of colors to meet every need from the palest to the deepest and the darkest shades.

Visit our website
www.huntsman.com/textile_effects
Selecting a Textile Testing Lab (Part Two)
By Diana Wyman, AATCC Technical Director

There are many options for textile testing and it isn't always easy to find a lab perfectly suited to your needs. This series of articles touches on some of the questions to ask—of yourself and of the lab—before making your choice.

Choosing a textile testing lab is like choosing a doctor. You want to be sure the lab is well trained in the areas that matter to you. You want to have clear and open lines of communication. And you want to know that the instruments are up to date and in working order. Even a world-famous surgeon isn't much use with a dull scalpel.

**Calibration**

Calibration is one way of verifying that a lab instrument is working properly. Calibration is a check of certain instrument parameters—velocity, weight, distance, etc.—at a specific point in time. Keep in mind that calibration is just a check. If the check finds everything to be within tolerance, the instrument is considered “calibrated.” If the check turns up a problem, further action is needed. An instrument is considered “out of calibration” or “uncalibrated” if some parameter is not within the specified tolerance, or if the check has not been performed within the specified interval.

A calibrated instrument doesn't guarantee that tests performed by the instrument will yield accurate results. It doesn't even guarantee that the calibrated parameters will be the same the next time a test is performed. Maintaining a good calibration procedure and schedule does greatly improve the probability that the instrument will produce accurate results with each use.

**In-House Calibration**

Some calibrations can be performed by laboratory staff without sophisticated tools or training. In fact, some instruments need to be calibrated so frequently (daily, or before each use) that it would be impractical to calibrate them any other way.

Certain calibrations are performed as part of the associated test method. For example, the first step in the procedure for AATCC Test Method (TM) 22, Water Repellency: Spray Test is to “Calibrate the apparatus.” This simply requires pouring 250 mL of water into the apparatus funnel and measuring the time for it to pass through.

A lab may do other calibrations on a routine basis. AATCC Monograph (M) 6, Standardization of Home Laundry Test Conditions, provides “simple procedures…to calibrate the top loading washing machines.” It is recommended that these be performed “at a minimum once a year.”

Some calibrations are not explicitly described in a test method. They may be prescribed by the manufacturer or they may be developed by the lab. Placing check weights on a scale is one example of this type of calibration. This can be done on a regular basis—weekly, monthly, or annually—or before each use.

**Professional Calibration**

For calibrations that are too complicated, or just too time consuming, to be performed by lab staff, a specialist may do the job. These calibrations may require sophisticated tools or traceable standards.

Some manufacturers will calibrate their own instruments, either by sending a representative to the lab...
Discover new possibilities in colors and effects, and address consumers’ longing for more sustainable fashion. Archroma’s award-winning ADVANCED DENIM technology brings you the benefits of innovative denim dyeing and finishing, with the responsible use of the Earth’s resources.

Higher in color and creativity, lower in eco-impact

ADVANCED DENIM

We touch and color people’s lives every day, everywhere

www.archroma.com
or by having the instrument shipped to the manufacturer’s facility. There are also companies that calibrate a range of instruments.

Replacement
For instruments that fail a calibration check, adjustment or repair may solve the problem. Only in extreme cases will they need to be completely replaced. There are some tools, however, that should be replaced regularly rather than calibrated. AATCC Gray Scales fit into this category. Each set of scales come with a certificate of conformity based on measurement of the individual gray chips. The entire scale is difficult to measure accurately once it is assembled. Instead of in-house calibration with a spectrophotometer, AATCC committee RA36 recommends replacing scales at least annually. Other items, such as multifiber strips, are suitable only for a single use. For items that will not be calibrated regularly, it is important to store them as recommended and verify the shelf life.

Calibration Schedules
Calibration is necessarily an ongoing process. How often it needs to be done depends on a number of factors, including how often an instrument is used, the required accuracy, and the instrument’s tendency to drift. Test methods and manufacturer’s instructions often include recommended calibration schedules, but individual labs may have valid reasons for modifying these schedules.

Documentation
So, how do you know if and when a lab calibrates its apparatus?

If you visit the lab, you will probably see calibration stickers on some instruments. Make sure the due date has not expired. For stickers with space to list multiple calibration dates, the dates should be at regular intervals.

Not all calibrations are documented with a sticker. There may be a log, certificate, or other record. If these aren’t posted near the instrument, don’t hesitate to ask. They may be filed elsewhere for safekeeping. Some instruments may also store calibration data electronically.

Digging Deeper
Generally, a current calibration sticker is a good sign that the lab maintains its instruments in good working order. If you want to be particularly diligent, check the frequency of calibration. You can also ask what the calibration entails. Was every bulb/filter combination in the lightbox checked, or just the one most frequently used? Was the tensile tester calibrated for load AND speed? In what range, and to what accuracy, was the scale calibrated?

There is a lot that goes into a calibration program that cannot be covered here, but knowing what to look for and what to ask is a good first step.

Test Method Development
Finding a lab with good and well-calibrated equipment is a good idea. But how can you tell if the lab’s staff is as well-calibrated as its equipment? One question to ask the lab is whether staff are involved in test method development. What this looks like, and what it means for your testing, can vary.

Standardized Test Method Development
Do lab staff participate in development of AATCC, ASTM, ISO, or other test methods? Do they attend meetings, belong to committees, and participate in trials to determine the precision and bias of proposed methods?

Being directly involved in the development process for standardized tests means lab staff know what changes are coming. They can help you make decisions about your testing in anticipation of those changes.

Those involved in the test method development process are also more likely to have read a method in detail. They have probably participated in discussions about best practices and correct interpretation of the method, so you get the benefit of not only your lab’s experience, but that of all the other parties involved in the development process.

Custom Test Method Development
Whether a lab participates in formal test method development or not, you may also want to know if the lab is willing to work with you on customized test methods. Does the lab offer a library of in-
house methods to choose from? Will they develop a method specifically to meet your needs? Will they perform a test you have developed?

Test method development is not as easy as it sounds. If a lab does agree to help you create or modify methods to suit your specific needs, make sure it isn’t the lab’s first attempt. Do all parties understand how the method is performed and what the results represent? Has the accuracy and repeatability been verified? Is there an existing standardized test that you could use? Are other organizations using similar methods?

The Bottom Line
Knowing that a lab is willing and able to be part of the test method development process is a good indication that it understands what goes into creating good methods. This can benefit your organization even if the only testing you do is with long-standing, standardized methods.

In Our Next Installment
For other questions to ask when choosing a testing lab, see the previous article in this series, that covers: Lab Affiliation, Proficiency, and Specialized Services. Stay tuned, our next issue will have more on Continuing Education, Customer Service, and Certification.
New Members Joining in December 2014 & January 2015 . . .

Delaware Valley Section, USA
Senior: Todd Holzbauer, W. L. Gore and Associates.
Student: Miranda Haslam, The College of William and Mary.

Gulf Coast Section, USA
Senior: Gregory Schmitt, global applications manager, Borregaard LignoTech.
Senior: Bhavin Shah.

NY-Metro Section, USA
Senior: Robert Negron, product development coordinator, New York and Co.
Senior: David Southard.
Senior: Annette Wilcox (self-employed).

Piedmont Section, USA
Senior: Sara A. Arvidson, research engineer, Milliken and Co.
Senior: Julie Brogden, manager, Hanesbrands Inc.
Senior: Jeff Carr, CFO and managing director, Pulcra Chemicals LLC.

Senior: Todd Danielson, global development manager, Milliken and Co.
Senior: Erika Ford, professor, North Carolina State University.
Senior: Paul Hardin, Crypton.
Senior: Jason Jensen, inside sales coordinator, J. A. King and Co. LLC.
Senior: Olga Levushenko, research associate, The Nonwovens Institute.
Senior: Nancy Mitchem, laboratory manager, Organic Dyes and Pigments LLC.
Senior: Brandon Sandy, technical manager, Guilford Performance Textiles.
Senior: Eduardo Torres, research and development manager, Milliken and Co.
Senior: Jim Williams, senior technical sales representative, Borregaard LignoTech.

Student Chapters
Central Michigan University, USA: Hannah McDonald and Kaley Sheldon.

Fashion Institute of Technology, NY, USA: Blaze Javier Mandela.
Florida State University, USA: Lyndsay Rothfarb.
Georgia Institute of Technology, USA: Janine Feirer.
North Carolina State University, USA: Edmir Silva.
University of California—Davis, USA: Melissa Farmer and Yiting Hao.
University of Massachusetts, USA: Michael Humphreys.
University of Nebraska, Lincoln, USA: Orchid Richards and Abigail Parodi.
University of Rhode Island, USA: Morgan Burns, Christiana Contrada, Greer Gagnier, Holly Gearing, Bailey Harrington, Michelle Katz, Amanda Palombo, Wang Qun, Chesley Russell, Gelila Shenkut, Riley St. Cyr, and Jenna Swanholm.
Virginia Polytechnic Institute and State University, USA: Kelsey Smith.
Independent Members—Worldwide

Senior: Norhaidah B. Aliash, quality assurance specialist, Eastern Decorator Sdn Bhd, Malaysia.

Senior: Phuong Anh Cao, quality assurance, Tran Hiep Thanh Textile Corp., Vietnam.


Senior: Anh Thi Ngoc Dang, quality control, Chunshin Precision Vina Co. Ltd., Vietnam.

Senior: Huong Thi Dau, supervisor, Eclat Fabrics VN, Vietnam.

Senior: Kissa DeNeen, Carhartt Inc., USA.

Senior: Andrzej J. Filarowski, technical director, Society of Dyers and Colourists, United Kingdom.

Senior: Xin Yong Gao, quality assurance manager, TTI Global Resources (Shanghai) Knitwear Distribution Co., China.

Senior: Linda Garrigan, sourcing director—soft goods, CamelBak LLC, USA.

Senior: Mario Gisinger, director of quality assurance, Swisstex Direct, USA.

Senior: Ching-Fa Hsu, quality control, Vantek Textile Co. Ltd., China.

Senior: Chongyan Huang, technician, Advanced Denim Co. Ltd., China.

Senior: Korina Kempf, color inspiration manager, Patagonia, USA.

Senior: Rajath Kumar, director, Intertek, USA.

Senior: Linda Li, business manager, Wintop Garments Co. Ltd., China.

Senior: Wen Xiu Li, test controller, Zibo Aodisen Hometex Co. Ltd., China.

Senior: Yafei Li, Eastern Decorator Sdn Bhd, Malaysia.

Senior: Ivy Liu, lab technician, Coach Consulting Dongguan Co. Ltd., China.

Senior: Zhen Liu, Eastern Decorator Sdn Bhd, Malaysia.

Senior: David Mravca, Amazon Lab126, USA.


Senior: Nhung Thi Nguyen, laboratory technician, Chunshin Precision Vina Co. Ltd., Vietnam.

Senior: Phung Nguyen, CTS softlines lab, SGS Vietnam Ltd., Vietnam.

Senior: Stefan Omvik, Borregaard LignoTech, Norway.

Senior: Elisabeth Palomares, materials engineer, Industrias Tricon de Mexico SA de CV, Mexico.

Senior: Daowu Pan, quality assurance supervisor, Chairworks Manufacturing Group Ltd., China.

Senior: Michael Profetto, vice president—product engineering, Gold Eagle Co., USA.

Senior: Selva Rajan, quality management executive, Eadeco Sdn Bhd, Malaysia.

Senior: Ravi Rangarajan, senior marketing manager, Wacker Chemical Corp., USA.

Senior: Kanyarat Rangsanga, Thailand Textile Institute, Thailand.

Senior: Chowdhury Rubaiyat, associate professor, Ahsanullah University of Science and Technology (AUST), Bangladesh.

Senior: Feng Jian Shao, salesman, Shangtex Shanghai Textile Decoration Co. Ltd., China.

Senior: Scott Springmier, business development manager, TAPPI, USA.

Senior: Ling Sun, compliance testing manager, Orca Ltd., China.

Senior: Ying Ying Sun, technician, Zhejiang Weixing Industrial Development Co. Ltd., China.

Senior: Eddy Szczerbinski, teacher/consultant, Zerbinnovations, Canada.

Senior: Jiang Taibin, Haifeng County Hapchant Dyeing Knitting Factory Ltd., China.

Senior: Amanda Thomas, account manager, TAPPI, USA.

Senior: Trieu Quoc Tran, quality assurance manager, Tran Hiep Thanh Textile Corp., Vietnam.

Senior: Truc Thi Thanh Tran, quality assurance lab staff, Meraki FW Inc., Vietnam.
New Corporate Members

Borregaard LignoTech

Borregaard LignoTech focuses on wood-based specialty chemicals, using lignins and lignosulfonates. Active in 80 countries primarily through direct sales, the company’s innovation efforts are channeled from the market to its research and development centers in Europe and North America. Borregaard’s LignoTech’s products are large water-soluble biopolymers which possess both hydrophobic (water repellent) and hydrophilic (water attractive) regions. With the addition of water, the molecule can move and adjust itself to its surroundings. Headquartered in Sarpsborg, Norway, Borregaard LignoTech employs approximately 600 people. The company continuously strives to develop wood-based renewable products for new applications.

Haifeng County Hapchant Dyeing Knitting Factory Ltd.

Established in 1995, Hapchant Dyeing Knitting Factory is an independently-owned export and import company, located in Shanwei, Guangdong Province, China. The company produces, manufactures, and dyes yarns with an annual capacity of 25 to 30 million pounds. Hapchant primarily exports cotton, acrylic, polyester, wool, and other blended yarn products to Gap, Walmart, and Kohl’s in the USA, Europe, and southeastern countries.

In 2007, Hapchant was awarded “Role Model of Taxers” by the government of Haifeng. The company has been recognized for protecting the environment by minimizing its discharge of pollutants in Guangdong Province.

Wacker Chemical Corporation

Wacker Chemical Corp. produces a variety of chemicals, with its business divisions focusing on silicones, polymers, siltronic (hyperpure silicone), polysilicons, and biosolutions. The company services many industries including automotive, chemical, construction, consumer care, food, health care, life sciences, and textiles.

Wacker offers customized solutions for unique functions and effects for textile finishing including color intensification, water-repellent treatment, softeners, dimensional stability, and textile printing. Integrated concepts for functional coatings are offered for technical textiles. The company also offers optional applications for nonwovens, and leather and fiber finishing.

The company has a global network of production sites, sales offices, and distributors, with 16,000 employees on five continents. Headquartered in Munich, Germany, Wacker Chemical Corp. has several locations in the USA, including its Adrian, MI, USA plant facility, which is ISO 9001, ISO 14001, and RC14001 registered and observes global chemical industry Responsible Care guidelines.
Gavin Receives Prestigious Award

In September 2014, the Samuel Ginn College of Engineering at Auburn University presented Charles E. Gavin III, past president and treasurer of AATCC, with the 2015 Distinguished Auburn Engineer Award.

Gavin graduated from Alabama Polytechnic Institute in 1959 with a degree in textile management, as well as an Executive MBA from the University of North Carolina at Chapel Hill in 1977. In a career that covered 20-plus years in the carpet industry, Gavin worked his way through a range of assignments and was responsible for numerous technical achievements within the carpet industry, including the development of the use of acid dyes to replace disperse dyes, which gave carpet improved light and washfastness. This soon became the industry standard and remains so today.

In 1981, Gavin formed MFG Chemical Inc. to develop and market improved chemical auxiliaries for the dying and finishing of carpets. Today, MFG has grown from a husband-and-wife team to a four-site chemical manufacturer serving a broad segment of the chemical market. Gavin, who presided over tremendous growth of the company, remains chairperson of the board.

Gavin’s leadership at AATCC during his tenure as president, 1999-2000, led the Association’s move to the international arena. Gavin joined AATCC as a student member at Auburn and has served in many capacities. In 2003, he received the prestigious Chapin Award for his outstanding service to the association and to the textile industry. Gavin was instrumental in forming the AATCC Foundation in 1997 and has served as treasurer and chair of the charity. Upon his retirement, he was named treasurer emeritus for both the Association and the Foundation and was recognized for his philanthropic endeavors.

In 2000, Gavin and his wife, Carol Ann, formed the Gavin Family Scholarship, administered by the AATCC Foundation, which provides two-year scholarships in textile engineering, textile chemistry, polymer and fiber engineering, and chemical engineering.
Weigl Appointed Vice-President
Americhem Inc. announced the appointment of Thomas Weigl as vice-president and managing director for the company’s Europe, Middle East, and Africa region. Americhem’s president, John Deignan, says, “Weigl brings extensive experience in the polymer industry and global organizational and team building skills to this position.”

Weigl most recently served as CEO and member of the board of directors for Sukano AG, producers of functional and optical masterbatches and specialty compounds for the plastics industry. Prior to Sukano, he held similar positions at Dolder AG.

Obituary
Edward John Elliott, 85, of Charlotte, NC, USA, passed away January 16, 2015. He served in the Korean War as a cryptographer and member of the US Army Signal Corps, was stationed in Nome, Alaska, and trained at the Army Security Agency in Virginia.

Elliott attended Clemson University, receiving a BS in chemical engineering. He then joined Becco (FMC Corp.) where he served as technical service representative and worked in research and development. In 1977, he joined Hunter & White, a predecessor to Ford, Elliott, and Trimble, of which Elliott was a principal partner. After his retirement in 1994, Elliott was a regular contributor to Textile World, and served on the Mecklenberg County Waste Water Commission.

Elliott was a registered professional engineer (PE); professional land surveyor; and certified physical/chemical and biological systems operator. He was a member, certified chartered colorist, and fellow of the Society of Dyers and Colourists (SDC); co-author of a US patent; and a member of the American Arbitration Association.

Elliott was honored as an AATCC 50-year member in 2000, and enjoyed attending AATCC’s International Conferences. He participated in the RA 34 Preparation of Test Methods Committee, and was a member of AATCC’s Northern New England, Niagara Frontier, Metropolitan, Palmetto, and Northern Piedmont sections.

Elliott is survived by his wife of 51 years, Margaret Wossick Elliott; his son, Christopher John Elliott and daughter, Catherine Elliott Armitage; and six grandchildren. Condolences may be offered at www.HarryandBryantFuneralHome.com.

http://www.aatcc.org/events/online/test_method_training.htm

AATCC Test Method Online Training Videos

AATCC test method online training videos are designed to explain and demonstrate the more commonly used AATCC Test Methods and Evaluation Procedures.

FEATURES & BENEFITS
• Step-by-step visual instruction
• Demonstration of correct techniques
• Text and audio narration
• Learn at your own pace from anywhere
• View & pay for only the modules you need
• No travel expense

Inquiries please contact Garry Atkinson
+1.919.549.3544 | atkinsong@aatcc.org
Custom AATCC Wash Cycle
Machines Available

Testing labs and other interested parties can now purchase washing machines programmed specifically to perform the wash cycle described in AATCC Monograph 6 (M6), Standardization of Home Laundry Test Conditions.

Several test methods and procedures call for standardized home laundering. In 1984, AATCC Research Committee RA88, Home Laundering Technology, developed M6 to establish a consistent set of test conditions for all test methods involving home laundering. Although laundering technology and model numbers change regularly, it is not practical or desirable for labs to replace washing machines every year. The committee worked with a major washing machine manufacturer to introduce machines with a specially-programmed cycle. This cycle will allow labs to purchase available machines in subsequent years, while maintaining the same laundering conditions.

The AATCC Wash Cycle—sometime referred to as the “keydance” cycle—is programmed in several commercially-available washing machine models.

A list of these models and instructions for accessing the AATCC Wash Cycle are available at www.aatcc.org/testing/supplies/washers.htm.

Both traditional and high efficiency top-load, 120V/60 Hz washing machine models are equipped with the AATCC Wash Cycle. Front load and 220V models with the custom cycle are being developed. Currently, the AATCC Wash Cycle is limited to Normal Cycle with Warm Wash. Delicate Cycle and alternate wash temperatures may be accessed through normal machine settings.

AATCC provides a list of models meeting monograph parameters as a service to users of the monograph and related test methods. The Association does not verify the parameters of washing machines or dryers. The published lists include machines reported by the manufacturer to meet the most recent parameters listed in the monograph.

New Global Trainers

This January, the AATCC Technical Center hosted two new individuals joining the AATCC Global Training program: Ms. Phung Nguyen from SGS Vietnam, and Mr. George Lam from SGS Hong Kong. We look forward to the classes that these new trainers will teach, and welcome them to the program!
New Global Training Graduates
Congratulations to the graduates of the global training classes at Intertek Vietnam, and SGS China (Ningbo), and to the graduates of the Best Practices using AATCC Gray Scales for Visual Color Assessment class at SGS Singapore.


Global training class at Intertek Vietnam.

Global training class at SGS China.
AATCC’s 2015 International Conference will be held March 24-26 at the Hilton DeSoto in Savannah, GA, USA. The conference will include three educational tracks, poster session, student paper competition, welcoming reception, and Awards Luncheon where the Association’s most prestigious awards will be presented.

Hilton DeSoto—Savannah, GA, USA
March 24-26, 2015

EDUCATIONAL PROGRAM

Wednesday, March 25, 2015
9:30 am   Keynote Presentation—Topic and Speaker TBA
10:10 am   Break

CONCEPT 2 CONSUMER® TRACK

Abstracts: www.aatcc.org/ic/tracks/c2c.cfm

Wednesday, March 25, 2015
10:30 am ‒ 12:00 pm   COLOR & LIGHTING: "BRIGHT IDEAS"
Moderator: Karen Kyllo, SGS Consumer Testing Services
10:30 am   Color and Lighting Update—Ann Laidlaw, ACL Color Consulting LLC
11:00 am   LED Lighting in Museums: Conservation and Color of Textiles—Mary Ballard, Smithsonian Institution
11:30 am   Light Color and Color Quality Possibilities With LED—Eric Haugaard, Cree

1:45 ‒ 4:00 pm   CONCEPT INNOVATION
Moderator: Kerry King, Spoonflower Inc.
1:45 pm   The Testing and Evaluation Process of Developing a Digitally Printed High Performance Sustainable Textile Wallcovering and Upholstery for Commercial Applications—Martin Gurian, Designtex
2:15 pm   Accurate and Complete Color Communications Equals Accurate Color—John Darsey, Color Solutions International
2:45 pm   Break
3:00 pm   Innovation Ideation from Concept to Commercialization—Portia Blunt, New Balance
3:30 pm   Cotton Innovations: Latest Knit and Woven Fabric Collections for the Apparel and Home Markets—Yvonne Johnson, Cotton Incorporated

Thursday, March 26, 2015
9:00 ‒ 10:00 am   MATERIALS DEVELOPMENT
Moderator: Tiffany Eubanks, Innovative Textile Printing
9:00 am   Temperature Regulating Fabrics—Renuka Dhandapani, Cotton Incorporated
9:30 am   Innovation in a Regulated World—Joe Walkuski, TEXbase
10:00 am   Break

10:15 ‒ 11:45 am   CONSUMER PRODUCT INTERESTS
Moderator: Heidi Carvalho, Rothtec Engraving Corp.
10:15 am   Natural Colorants: Making the Right Choice Easier—Sarah Bellos, Stony Creek Colors
10:45 am   Choosing a Fit Model for Smart Garments: A Case Selection Approach using 3D Body Scanning—Mahendran Balasubramanian, Oklahoma State University
11:15 am   Evaluation of Apparel Quality from the Consumer’s Perspective—Laurel Romeo, Louisiana State University
CONSUMER PRODUCT INTERESTS
Moderator: Carol Revels, Lands’ End Inc.
2:15 pm Digital Textile Printing: Current State of Technology—Johnny Shell, Specialty Graphic Imaging Association (SGIA)
2:45 pm The Quest for Performance Features: Consumers’ Expectations Revealed—Kim Kitchings, Cotton Incorporated
3:15 pm Cotton is the “Frenemy”: The Story of Under Armour’s Charged Cotton—Tom White, Under Armour

CHEMICAL APPLICATIONS TRACK
Abstracts: www.aatcc.org/ic/tracks/chem_apps.cfm

Wednesday, March 25, 2015
10:30 am – 12:00 pm SUSTAINABILITY IN TEXTILES
Moderator: Kanti Jasani, Performance & Technical Textile Consulting
10:30 am Advances in Sustainable Textile Wet Processing—Peter Hauser, North Carolina State University
11:00 am The Changing Landscape of Chemicals in Consumer Products—Amanda Cattermole, Cattermole Consulting Inc.
11:30 am Ecological Dyeing Cellulosic Fibers with Novel Insoluble Reactive Dyes—Jaime Gomes, ECOFOOT

1:45 – 4:00 pm HERMAN AND MYRTLE GOLDSTEIN STUDENT PAPER COMPETITION
Moderator: Fred Cook, Georgia Institute of Technology
Student papers are judged on originality, scientific value, and presentation. First, second, third, and fourth place awards are presented.

Thursday, March 26, 2015
9:00 – 11:15 am ADVANCES IN WET PROCESSING
Moderator: Bryan Dill, Archroma
9:00 am Efficient and Responsible Methods for Indigo Dyeing and Garment Washing—Mike Tyndall, Cotton Incorporated
9:30 am Novel Innovations for the Cold Temperature Textile Processing—Ole Bill Jorgensen, Novozymes A/S, Denmark
10:00 am Break
10:15 am Compatibility between C6 Water Repellent and Fire Retardant for a One-Step Treatment—Magali Brown, NICCA USA
10:45 am Recent Developments in Environmentally Friendly Wrinkle Free Finishes of Cotton Fabrics—Gang Sun, University of California, Davis

11:15 – 11:45 am ADVANCES IN SPECIALTY MATERIALS AND FINISHING
Moderator: Nelson Houser, M. Dohem, USA
11:15 am Fast Drying for Textiles: Energy Saving via Surface Chemistry Approaches—Jiping Wang, Zhejiang Sci-Tech University, China

2:15 – 3:45 pm ADVANCES IN SPECIALTY MATERIALS AND FINISHING (cont’d)
2:15 pm Evaluation of Active Moisture Management Effects with Standards and Adapted Test Methods—Emiel DenHartog, North Carolina State University
2:45 pm Fluoro and Non-Fluoro Chemistry for Repellency: Where We Are and Where Are We Going?—Geoffrey Gettliffe, Archroma
3:15 pm Evaluating Insulative Materials for Conductive Thread—Mary Ruppert-Stroescu, Oklahoma State University
Wednesday, March 25, 2015

10:30 am – 12:00 pm  PROTECTIVE TEXTILES

Moderator: Seshadri Ramkumar, Texas Tech University

10:30 am  Ventilation of Firefighter Turnout Gear: Reducing Heat Stress and Improving Physiological Comfort—Meredith McQuerry, TPACC, North Carolina State University

11:00 am  Pilot Scale Coating of Fabrics with Fluorodecyl Polyhedral Oligomeric Silsesquioxane/Fluoroelastomer Blends for Water and Liquid Chemical Repellent Clothing—Quoc Truong, US Army Natick Soldier RDE Center

11:30 am  Plasma Enhanced Synthesis of Flame Retardant Cellulosic Materials—Majid Sarmadi, University of Wisconsin, Madison

1:45 – 4:00 pm  MEDICAL TEXTILES

Moderator: Brian Shiels, PBI Performance Products Inc.

1:45 pm  Self-Sanitizing Textile—Gina Sloan, Microban International

2:15 pm  Measuring Compression in Compression Garments—Erin Kirkpatrick, Exponent

2:45 pm  Break

3:00 pm  Advances in Antimicrobial Testing Using Globally Harmonized, Industry Accepted Test Methods—Robert A. Monticello, International Antimicrobial Council

3:30 pm  Novel Bi-component Fibers for Medical Applications—Walter Chappas, Georgia Southern University

Thursday, March 26, 2015

9:00 am – 11:45 am  FUNCTIONAL MATERIALS

Moderator: Fred Cook, Georgia Institute of Technology

9:00 am  Functionalization of Nylon 6 Nanomembranes with Polyester Coated Fe₃O₄ Nanoparticles for Water Treatment Applications—Nidia Trejo, Cornell University


10:00 am  Break

10:15 am  Agrochem-Based Chemistries for Biomedical and Commercial Applications—Michael Jaffe, New Jersey Institute of Technology

10:45 am  Plasma Coupling for Improved Herbal Finishing of Textiles—Seshadri Ramkumar, Texas Tech University

11:15 am  Topic and Speaker TBA

2:15 – 3:45 pm  NEW DEVELOPMENTS

Moderator: Robina Hogan, United Soybean Board

2:15 pm  Simultaneous Measurements of Cotton Fiber Maturity, Fineness, Ribbon Width and Micronaire—James Rodgers, USDA-ARS-SRRC

2:45 pm  Textile Size from Soyproteins for High Speed Weaving—Helan Xu, University of Nebraska

3:15 pm  Novelty Nonwoven Made of Flax—Marc Jolly, Norafin Inc.
**Note:** Program is subject to revision, additions, and change. Please refer to [www.aatcc.org](http://www.aatcc.org) for the latest updates.

**PRESENTATION ABSTRACTS**
Presentation abstracts for the C2C, Chemical Applications, and Materials Tracks may be viewed at AATCC’s website, [www.aatcc.org](http://www.aatcc.org).

**POSTER SESSION**
Posters will be available for viewing during the March 24 Welcoming Reception and the following day. Presenters will be in attendance on March 25 from 4:30 – 5:30 pm to discuss their research and address questions.

**TABLETOP EXHIBITS**
Tabletop exhibits will feature CAD/CAM systems and software; color management software, systems, and solutions; auxiliaries, dyes, and chemicals; and testing equipment and services for the apparel and textile wet processing industry. Exhibits will be open during the Welcoming Reception on March 24 and from 8:00 – 9:20 am and 4:15 – 6:00 pm on March 25. A continental breakfast will be served in the exhibit area from 8:00 – 9:20 am on March 25 and a reception will be held in the exhibit area that afternoon from 4:15 – 6:00 pm. Admittance to the exhibit area will require a conference badge.

**EXHIBIT OPPORTUNITIES**
For information on exhibiting, visit our website, [www.aatcc.org](http://www.aatcc.org), and select 2015 IC/Tabletop Exhibits.

**CONFERENCE EVENTS**

**WELCOMING RECEPTION**
A Welcoming Reception will be held on Tuesday, March 24, from 6:00 – 8:00 pm in the exhibit area. Socialize with your colleagues and visit the tabletop exhibits while enjoying hors doeuvres and beverages.

Full registration includes ONE ticket to the Welcoming Reception. Additional tickets may be ordered in advance at US$35 each.

**AWARDS LUNCHEON**
The Awards Luncheon will be held from 12:00 – 2:00 pm on Thursday, March 26. The program will feature the presentation of the Olney Medal for outstanding achievement in textile chemistry, the Harold C. Chapin Award for service to AATCC, the Young Entrepreneur Award, the AATCC Education Award, the J. W. Weaver Award for best paper published in the *AATCC Journal of Research*, and the winners of the Herman and Myrtle Goldstein Student Paper Competition.

Full registration includes ONE ticket to the Awards Luncheon. Additional tickets may be ordered in advance at US$40 each.

**OLNEY MEDAL ADDRESS**
The Olney Medal Address will be presented on Thursday, March 26, from 8:15 – 8:55 am

**HERMAN AND MYRTLE GOLDSTEIN STUDENT PAPER COMPETITION**
The Herman and Myrtle Goldstein Student Paper Competition will be held Wednesday, March 25, from 1:45 – 4:00 pm. Papers are judged on originality, scientific value, and presentation. AATCC Interest Groups provide the judges whose balloting determines the order of finish. Results of the competition will be announced at the Awards Luncheon.

**CONFERENCE VENUE**
The conference will be held at the Hilton Savannah DeSoto located at 15 East Liberty Street in Savannah, Georgia USA. The hotel is steps from Savannah’s treasured landmarks, museums, theaters, parks, and incredible dining and shopping. Walk to exciting attractions like River Street, City Market, Forsyth Park, Historic Savannah Theater, and Savannah College of Art & Design.

**ACCOMMODATIONS INFORMATION**
A room block has been reserved at the Hilton Savannah DeSoto, 15 East Liberty Street, Savannah, Georgia, USA, +1.877.280.0751. Reservations should be made directly with the hotel and attendance at the AATCC conference should be specified to receive the group rate of US$159 double/single. A first night’s room and tax deposit are due with each reservation. Deposits may be made by check or charged to an accepted credit card. **Group rate will be honored until March 2 unless room block fills prior to cut off date.** Any changes to your hotel reservation must be made directly with the hotel.

**REGISTRATION INFORMATION**

**Pre-registration deadline:** Tuesday, March 3.

**On-line:** (payment by credit card only) Complete the form at [www.aatcc.org](http://www.aatcc.org).

**Fax:** (payment by credit card only) Complete the registration form and fax to +1.919.549.8933.

**Mail:** (payment by credit card or check) Check should be made payable to AATCC in US dollars drawn on a US bank. Mail check to AATCC, PO Box 12215, Research Triangle Park, NC 27709-2215 USA. The Association will accept MasterCard, VISA, or American Express.

---

Use the Twitter hashtag #a2ic15 to Tweet at the Conference!
Pre-registrants will be sent confirmations. After March 3, you must register on site and increased fees will apply. Badges, function tickets, and conference materials may be picked up on site at the AATCC Registration desk located in the Hilton Savannah DeSoto Hotel. A conference badge is required to enter all the sessions and exhibits. Lost badges will be replaced at a cost of US$35 each.

CANCELLATION/REFUND POLICY
Registration cancellations received in writing by March 3 at the AATCC Technical Center will be honored minus a US$75 administrative fee. No refunds will be given after March 3. Cancellation requests may be faxed, e-mailed, or mailed to AATCC, PO Box 12215, Research Triangle Park, NC 27709-2215 USA; fax +1.919.549.8933; e-mail nicholk@aatcc.org.

SPONSORSHIP OPPORTUNITIES
Sponsorship opportunities are available to promote a company’s presence at our conference. These include having your company’s name and logo on the front cover of our conference program booklet or Awards Luncheon program; sponsoring a morning break or carving station at our Welcoming Reception; being a sponsor of our Welcoming Reception or keynote speaker and more. A list of these sponsorships and the minimum contributions are posted on our website under IC Sponsorship Opportunities.

CONFERENCE PROCEEDINGS
Conference papers and/or PowerPoint presentations will be made available for download to attendees prior to the conference.

AATCC GRATEFULLY ACKNOWLEDGES OUR SPONSORING MEMBER COMPANIES:

- Cotton Incorporated
- M. Dohmen USA
- SGS Consumer Testing Services
- ITG/Burlington
- 3M
- Color Solutions International
- Pulcro Chemicals LLC
- Consumer Testing Laboratories Inc.
- Huntsman
- UL Consumer Products
- SDL Atlas

Stay Until the End to Win
As an added incentive for all attendees to remain for the entire program, we will have a drawing at the conclusion of each educational track on Thursday, March 26, for a Kindle Fire HD. Tickets will be provided to all in attendance and you must be present to win.

PRE-CONFERENCE EVENT
TECHNICAL TEXTILES 101 TUTORIAL
2:00 – 5:15 pm Tuesday, March 24

The tutorial will be taught by Dr. Seshadri Ramkumar, Nonwovens & Advanced Materials Laboratory, Texas Tech University.

This seminar will present an overview on specialty/industrial textiles, provide a classification of different technical textiles, and concentrate on a few sectors such as functional finishes and products, protective materials, nanotechnology, filters, and nonwovens. The discussion will include product examples and processes that are used to develop these products. The major focus of the tutorial is to provide a broad understanding of the field of non-traditional textiles and opportunities for the textile industry. Overall, the participants will understand the vast scope offered by the technical textiles sector, which can gear conventional textiles towards a high-tech industry.

The tutorial is not included with the conference registration. A discounted tutorial registration fee will be available to individuals attending the conference.
S. Haig Zeronian is the 2014 Olney Medal Recipient

S. Haig Zeronian is the 2014 recipient of the Olney Medal for his significant research contributions on the relationship between polymer structure and single fiber mechanical properties in natural and manufactured fibers.

Zeronian received an Honors in BSc Tech and a MSc Tech in Textile Chemistry from Manchester University in 1953 and 1955, respectively. After receiving his masters, he was drafted into the UK Royal Air Force for national service. From there, he worked for two years as a research officer in the Chemistry Department of the British Cotton Industry Research Association (also known as the Shirley Institute), before returning to the University of Manchester in 1960. He received his PhD in Cellulose Chemistry in 1962, and went to work as a research fellow at the Institute of Paper Chemistry in Appleton, WI, USA. After a year, he returned to Manchester, UK, as a senior research fellow in Nonwoven Fabrics at the University of Manchester Institute of Science and Technology. Two years later, he took an appointment as a research associate in the Cellulose Research Section of Columbia Cellulose Co., Ltd., in Vancouver, BC, Canada.

In 1968, Zeronian became an assistant professor in textile science at the University of California, Davis, CA, USA. From 1978 through 1986, Zeronian chaired the Division of Textiles and Clothing. He received a DSc in Polymer and Fiber Science from the University of Manchester in 1983, while continuing to progress to full professor at the University of California, Davis. In 1983, he added professor of Mechanical Engineering (Materials Sciences) to his list of duties at University of California, Davis. He is now professor emeritus of the Division of Textiles and Clothing, University of California, Davis, and continues to speak on the chemistry of cellulose.

Achievements

Zeronian has made significant contributions to the understanding of the relationship of fiber structure and properties for natural and manufactured products, manufactured fiber structure, and degradation mechanisms; as well as the location of water, dyes, and textile finishes in cotton fibers. Zeronian’s research on the mechanical properties of natural and manufactured fibers has been primarily tensile, but has also included brittleness (measured by the breaking twist angle [BTA] method), and flex life. Some of his research used various probes to determine structure, including dyes and other chemical treatments, and high-energy radiation. His research on cotton has included the effects of mercerization, liquid ammonia treatment, and crosslinking on physical properties, including differences in the brittleness, flex life, and tensile properties of different species.

Zeronian’s research group of graduate students, colleagues, and visiting scholars to the Zeronian Laboratory have made significant contributions to the understanding of cellulose water relations, and the cause of hysteresis in the sorption isotherms of cellulose. Zeronian also studied the many aspects of textile finishing, including the influence of moisture on the flame resistance of fabrics, a comparison of the hydrolysis of cotton after slack and tension mercerization by enzymatic and acid hydrolysis, and the effect of fine structure and morphology on the properties of crosslinked cellulotic fibers.

Zeronian has published more than 120 papers and three textbooks, and has presented over 75 technical talks at professional meetings.

Honors and Awards

Zeronian is a member of the American Chemical Society (Cellulose, Paper, and Textile Division), and...
from this society he received two awards: The Division Fellow Award in 1993, and the Anselme Payen Award in 1996.

Zeronian is a senior emeritus member of AATCC; he joined the Association in 1969. He is a member of the Fiber Society, and this year, was accorded honorary membership. He also served on the editorial board of the journal, *Cellulose*.

**The Olney Medal**
Established in 1944 in honor of Louis Atwell Olney, the founder and first president of AATCC, the Olney Medal recognizes outstanding achievement in textile or polymer chemistry or other fields of chemistry of major importance to textile science. The award consists of a gold medal, a scroll, and an honorarium. Presentation of the medal each year is a highlight of AATCC’s International Conference. This year, the conference will be held at the Hilton Savannah Desoto, Savannah, GA, USA from March 24-26, 2015. The Association will present the Olney Medal at the Awards Luncheon on March 26, 2015.

Zeronian will deliver the traditional Olney Medal Address on March 26 at 8:15 a.m. The title of his talk is “Contributions to the Chemistry and Physics of Cotton Fibers.” For a complete list of our esteemed past award recipients, visit www.aatcc.org/awards/olney.htm

Kanti A. Jasani is the Harold C. Chapin Award Recipient
In recognition of his outstanding service to the Association, AATCC has named Kantilal (“Kanti”) A. Jasani as the 2014 recipient of the Harold C. Chapin Award.

**AATCC Activities**
Kanti Jasani has served the Association with honor and distinction since he became a member in 1972. Jasani has viewed his career in textiles and membership in AATCC as a harmonious blending of service to the worldwide textile community.

Jasani is currently the Regional Board Member for the Central Atlantic Region; he also serves on the AATCC Board of Directors. Jasani has served on the following test method committees for over 20 years: Home Laundering Technology, Colorfastness to Washing, Appearance Retention, Color Measurement, and Colorfastness to Atmospheric Contaminants. He has served on UV Protective Textiles, Global Sustainability Technology, Evaluation of Materials & Products for End User Performance, and Global Sustainability Technology for 15 years or more. He is a member of the Committee on Conferences and Membership Committee. He also serves on the AATCC Foundation Student Research Support Grant Committee, and has served in this capacity since 2000.

Jasani was a member of Hand Evaluation and Colorfastness to Perspiration Test Method Committees. He served on the Education Advisory Board, Textile Education Committee, and Publications Committee. He also served on the AATCC Olney Award Committee from 1998-2002, and chaired this committee in 2003.

Nationally, Jasani was AATCC Regional Vice-President from 2003-2005, and AATCC Central Atlantic Regional Board member from 2005-2008. Locally, he joined the AATCC Delaware Valley Section in 1999, and is an active member of this section. He also was a member of the AATCC Hudson Mohawk Section from 1975 to 1993 and, during this time, was active in several positions.
Jasani is a champion of the Association and promotes its mission and vision locally, nationally, and internationally. His vast experience in the textile industry is reflected in the many contributions he makes to the Association. He is the passionate advocate for broadening the Association’s reach into the global textile market. He is the thoughtful voice at committee meetings, engaging others to consider the broad aspects and the minute details of each challenge, in order to safeguard the Association’s reputation as a leader in quality products, education, and test method development.

Other Honors and Achievements

Jasani earned a Textile Technology diploma from MS University in Baroda, India, in 1965, and a Bachelor’s degree in Textile Technology from MS University in 1967. He also earned a Master’s degree in Textile Technology from North Carolina State University (NCSU) in 1971. He worked as Quality Control Manager at Native Textiles until 1982, and later became Technical Director there until 1993. He joined Guilford Mills in 1993 as Technical Director. While at Guilford Mills, Jasani developed a US Patent for “Plastisol Printed Dyed Polyester Fabrics” in 2002. He retired from Guilford Mills in 2005. Since then, Jasani has been owner and president of his own consulting firm, Performance and Technical Textile Consulting.

Jasani is a member of Rotary International, and has served as President of the Glens Falls Rotary Club. Rotary International named him a Paul Harris Fellow in 1991. He has served as President of the Jain Society of Capital District NY from 1988 to 1993, and as Chair of the Jain Samaj of South Central Pennsylvania from 2010 to 2012. Jasani also served on the Board of the Asian Indian Americans of Central Pennsylvania from 2008 to 2011.

The Chapin Award

The Chapin Award was established in 1958 in honor of Harold C. Chapin, professor of chemistry at the Lowell Textile School, who served as national secretary of AATCC for nearly 25 years. The Association will present the Chapin Scroll during the International Conference Awards Luncheon that will take place March 26, 2015, in Savannah, GA, USA.

For a complete list of our esteemed past award recipients, visit www.aatcc.org/awards/chapin.htm

Sarah Bellos is the Young Entrepreneur Award Recipient

Sarah Bellos, founder and president of Stony Creek Colors, is the recipient of the AATCC Young Entrepreneur Award. Bellos is being recognized for producing regionally-sourced natural dye colorants and pigments for industrial use. By blending education and experience, she has developed “a complete agricultural supply chain to deliver reliable and safe bio-based dyes to the textile industry and help fashion brands reduce hazardous chemical use.”

The Foundation—Sustainable Agriculture

Bellos studied sustainable agriculture at the Center for Environmental Farming Systems (CEFS) at North Carolina State University (NCSU) in 2001. She then worked as a farm production manager at Dilmun Hill Organic Farm in 2002, while attending Cornell University College of Agriculture and Life Science. Besides working on her degree in Natural Resources Management at Cornell, she also participated in Cornell-in-Washington, where she interned in the Sustainable Enterprise Program at the World Resources Institute in Washington, DC, USA. She graduated from Cornell in 2004, receiving a BS in Natural Resources Management (cum laude), with a concentration in Resource Policy and Management. She then spent the next year interning as a research analyst in Corporate Benchmarking Services at Investor Responsibility Research Center in Washington, DC, USA.
Hands-On Experience

In November 2005, Bellos began ASK Apparel, where she monitored the manufacturing of naturally-dyed apparel and accessories for ASK Apparel brand (in-house) and external dye clients. She also managed wholesale accounts ranging from boutiques to national lifestyle chains, and direct retail sales.

A month after starting ASK Apparel, Bellos went to work with Food Security Partners of Middle Tennessee/Vanderbilt University Institute for Public Policy Studies in Nashville, where she planned and executed the first regional sustainable agriculture and community food systems conference.

From 2007 through 2011, Bellos became a part-time volunteer farmer and coordinator of Nashville Urban Harvest, where she was the lead coordinator of a one-acre urban vegetable farm. She managed employees, interns, and volunteers, as well as farmers’ market sales, including community-supported agriculture (CSA) share sales. During this time, Bellos was selected as a senior fellow in the Environmental Leadership Program (ELP) and participated in the training series for emerging leaders.

In 2009, she co-founded Artisan Natural Dye-works, where she operated and managed a garment dyehouse, dyeing custom piece goods for fashion designers and manufacturers. Her dyework and products have been showcased and sold at Whole Foods lifestyle sections, London Fashion Week, Cooper Hewitt Museum, Barney’s, Smithsonian Folk Life Festival, and Lake Eden Arts Festival. She also managed crop production, customer accounts, and financial operations. During this time, she collaborated on a white paper, entitled, "An Agenda for Change: A Vision for Creating a More Healthy, Just and Sustainable Food System for Our Region" for the Food Security Partners of Middle Tennessee/Vanderbilt Institute for Public Policy.

In 2010, she received a Rotary International Professional Scholarship to travel to central Turkey to learn from natural dye artisans. In 2011, she was awarded a Wild Gift Fellowship for her work connecting small farmers with high value crops.

A Perfect Blend

In 2012, Bellos partnered with Mark Cooley to create Stony Creek Colors. Her current work involves coordinating natural dye production with specialty

“(T)here is a long history of indigo growing in the southern United States. Indigo was one of the top three exported cash crops in the 1700s. The first synthetic dye, isolated from a coal-tar, was created in 1856; and soon after, synthetic versions replaced the market for natural color compounds, and this affected the amount of indigo and other natural dyes grown…. However, the beauty and vibrancy of natural dyes cannot be replaced, and it is our belief that the emerging environmentally-aware fashion industry will desire and purchase sustainably-grown natural dyes.” —S. Bellos, “Sustainable Cultivation of Plant-derived Indigo for Diversification and On-farm Value-added Dye Pigment,” Sustainable Agricultural Research & Education (SARE).
crops (i.e., indigo and black walnut) at three farms in Middle Tennessee and southern Kentucky. Partner Mark Cooley adds that Bellos "works with farmers and agricultural-waste industries on contract dye-growing, in-house and outsourced research on next-generation natural colorants, and industrial-scale colorant manufacturing."

Bellos currently works with the USDA Rural Development on a Value-Added Producer Grant, and is implementing a USDA Small Business Innovation Research Grant. In 2013, Bellos was part of the PERC Enviropreneur Institute for her innovative work to diversify small farmers into industrial dyes as more sustainable value-added crops.

As nominator Kathy Hattori notes, "Sarah has devoted her career to environmental stewardship by supporting regional, economic, and sustainable development. Her endeavors reach beyond the current supply chain and encompass agriculture, local manufacturing, and local textile processing using her dyes. Her ideas and products have the potential to build local economies, provide...jobs, and lessen the harsh environmental impacts of textile dyeing and finishing."

Bellos is a true, (indigo) blue, hands-on young entrepreneur, who will revive the natural dye industry one sustainable farm at a time.

**The Young Entrepreneur Award**

This award recognizes young entrepreneurs (less than 40 years of age) operating in the broader textile industry. An entrepreneur is defined as a person who has possession of a new enterprise, venture, or idea, and assumes significant accountability for the inherent risks and outcomes of the creation. Bellos will receive the Young Entrepreneur Award at the AATCC International Conference, held March 24-26, 2015 in Savannah, GA, USA.

For a list of past award recipients, visit [www.aatcc.org/awards/entrepreneur.htm](http://www.aatcc.org/awards/entrepreneur.htm)

---

**Spring Committee Meetings**

**May 5-7**

Research Triangle Park, NC, USA

Approximately 50 AATCC research and administrative committees will hold their semi-annual meetings this May. Unless otherwise noted, meetings are open to all interested parties. There is no fee to attend, and input is welcome. Attendees are particularly encouraged to attend the Technical Committee on Research (C3) meeting for an overview of technical committee activities.

**Guest Speakers & Special Events**

The following committees will feature guest speakers or special events during their meetings:

- **RA100, Global Sustainability Technology**, Tuesday, May 5, 10:15 am; Melissa McCullough, US Environmental Protection Agency; “21st Century and the Three Legs of Sustainability.”

- **Chemical Applications Interest Group**, Wednesday, May 6, 4:00 pm; R. Michael Tyndall, Cotton Incorporated; “Wrinkle Resistant Finishing without Formaldehyde: Can It be Done?”
• Several committees have indicated they may have speakers but names and topics were not known at press time. They are: RA80, Printing Technology; RA88, Home Laundering Technology; RA103, UV Spectroscopic Technologies; RA104, Garment Wet Processing Technology; Concept 2 Consumer® Interest Group; and Materials Interest Group.

• We would like to invite all to attend the Wednesday night, May 6, Technical Committee on Research (C3) meetings beginning at 5:30 pm, in order to learn more about the activities of the Association and the research committees. This is an open meeting and all are welcome.

Networking Reception
Tuesday, May 5, 5:30-6:30 pm
After a day of meetings, take the opportunity to mingle with industry colleagues over complimentary hors d'oeuvres, a complimentary drink ticket, and a cash bar.

Accommodations
Discounted daily rates of $135.00 are available at the DoubleTree by Hilton Raleigh-Durham Airport at Research Triangle Park located at 4810 Page Creek Lane, Durham, N.C. 27703 USA. Use the special reservation link on the AATCC website to obtain the rates, or contact the hotel directly at +1.919.941.4810 and mention the AATCC May Meetings to obtain the group rates. Reservations must be made by April 15 to ensure availability.

Pre-Registration Requested
Pre-register by Wednesday, April 29, to facilitate planning for the meetings. You may download the pre-registration form or you may register online on our website. After that date, you will need to register on site. There is no fee to attend these meetings.

www.aatcc.org/events/meetings
Tricia Day; +1.919.549.3534; dayt@aatcc.org

AATCC Spring Meetings
Unless otherwise noted, meetings are held at the DoubleTree Hotel, and are open to all.
* Closed meeting (committee members only)
+ Meeting held at the AATCC Technical Center

<table>
<thead>
<tr>
<th>Tuesday, May 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
</tr>
<tr>
<td>8:45-10:15</td>
</tr>
<tr>
<td>10:15-11:45</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>10:15-10:45</td>
</tr>
<tr>
<td>10:45-11:15</td>
</tr>
<tr>
<td>11:15-11:45</td>
</tr>
<tr>
<td>11:45-1:00</td>
</tr>
<tr>
<td>1:00-1:45</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Upcoming

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker/Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:45-2:30</td>
<td>RA50</td>
<td>Lightfastness and Weathering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA104</td>
<td>Garment Wet Processing Technology (Speaker TBA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C11</td>
<td>Committee on Conferences</td>
<td></td>
</tr>
<tr>
<td>2:30-3:15</td>
<td>RA49SC</td>
<td>Subcommittee to Discuss New Scope</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA59</td>
<td>Fibrous Test Materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA106</td>
<td>UV Protective Textiles</td>
<td></td>
</tr>
<tr>
<td>3:15-4:00</td>
<td>RA33</td>
<td>Colorfastness to Atmospheric Contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA43</td>
<td>Professional Textile Care</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA49</td>
<td>Insect Resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA80</td>
<td>Printing Technology (Speaker TBA)</td>
<td></td>
</tr>
<tr>
<td>4:00-5:30</td>
<td>RA24</td>
<td>Fiber Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA89</td>
<td>Hand Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA92</td>
<td>Interaction of Dyes and Finishes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C7</td>
<td>Publications</td>
<td></td>
</tr>
<tr>
<td>5:30-6:30</td>
<td></td>
<td>Reception</td>
<td></td>
</tr>
<tr>
<td>6:30-10:00</td>
<td>C2</td>
<td>Executive Committee on Research</td>
<td>*</td>
</tr>
</tbody>
</table>

### Wednesday, May 6

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker/Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30</td>
<td></td>
<td>Registration</td>
<td></td>
</tr>
<tr>
<td>8:00-8:45</td>
<td>RA36SC</td>
<td>Subcommittees on Light Level and Retail Lighting Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA88SC</td>
<td>Subcommittee on Programmable Washing Machines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA92SC</td>
<td>Subcommittee to work on Proposed New Scope</td>
<td></td>
</tr>
<tr>
<td>8:45-11:45</td>
<td>RA36</td>
<td>Color Measurement</td>
<td></td>
</tr>
<tr>
<td>8:45-10:15</td>
<td>RA31</td>
<td>Antimicrobial Activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA88</td>
<td>Home Laundering Technology (Speaker TBA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA87</td>
<td>Applied Dyeing and Characterization of Dyes</td>
<td></td>
</tr>
<tr>
<td>10:15-11:45</td>
<td>RA23</td>
<td>Colorfastness to Water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA102</td>
<td>Statistics Advisory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1-S14</td>
<td>Employee Benefits Committee *</td>
<td></td>
</tr>
<tr>
<td>11:45-1:00</td>
<td>C1-S8</td>
<td>Building and Grounds *</td>
<td></td>
</tr>
<tr>
<td>1:00-2:30</td>
<td>RA45</td>
<td>Finish Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA99</td>
<td>Technical Manual Editorial Review</td>
<td>Speaker-TBD</td>
</tr>
<tr>
<td></td>
<td>C6</td>
<td>Membership</td>
<td></td>
</tr>
<tr>
<td>2:30-4:00</td>
<td>RA42</td>
<td>Dimensional Change</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA56</td>
<td>Stain Resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA63</td>
<td>Water Resistance, Absorbency and Wetting Agent Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C6</td>
<td>Membership</td>
<td></td>
</tr>
<tr>
<td>4:00-5:30</td>
<td>RA60</td>
<td>Colorfastness to Washing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA75</td>
<td>Evaluation of Materials &amp; Products for End Use Performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C5</td>
<td>Appropriations *</td>
<td></td>
</tr>
<tr>
<td>5:30-6:30</td>
<td>C3</td>
<td>Technical Committee on Research (Open Meeting)</td>
<td></td>
</tr>
<tr>
<td>6:30-6:45</td>
<td>C2</td>
<td>Executive Committee on Research *</td>
<td></td>
</tr>
</tbody>
</table>

### Thursday, May 7

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker/Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-12:00</td>
<td>C1</td>
<td>AATCC Board of Directors *</td>
<td></td>
</tr>
</tbody>
</table>
Webinar: Weaving Compliance and Regulatory Requirements into Textile R&D
April 23, 11:00 am (EST)

The increasing demands of social compliance and regulatory requirements are forcing the industry to rethink our approach to textile research and development. It's a brave new world out there, with increasing complexity above and beyond the typical variables found within our supply chains. Product development processes must become pro-active by incorporating people and processes from the seemingly far-off worlds of legal, social compliance, chemical management, and global regulations.

Joe Walkuski, Founder and CEO of TEXbase Inc., will explain how to rethink your approach to developing textiles. Explore specific examples of process optimization and work stream automation that have demonstrated success in forming creative solutions to product innovation within our regulated world.

Walkuski founded TEXbase in 2002, after first developing the initial technology in 1995 while leading textile research and development at Patagonia, a position that he held for thirteen years. Walkuski is well known for industry-first textile innovations and supply chain developments including recycled materials and organic cotton. He is a graduate of the Fashion Institute of Technology, holds a US patent, and has won numerous awards for his contributions to the textile and apparel industries. TEXbase is a provider of collaborative software solutions for the textile, apparel, and footwear industries.

Registration: $99 for members (individual and corporate); $149 for nonmembers.
AATCC members, email Kim Nicholson at nicholk@aatcc.org for the coupon code with your member discount.
AATCC Sustainability Symposium & the 13th International Wool Research Conference

June 10–14
Zhejiang Sci-Tech University, Hangzhou, Zhejiang, China

The AATCC Sustainability Symposium, Innovation, Sustainability, and Quality: The Pathway to the Future, will be held in parallel with the International Wool Research Conference (IWRC). The symposium will be hosted by Zhejiang Sci-Tech University (ZSTU) and organized by ZSTU and AATCC.

Presentations will address:

- novel eco-textile materials
- eco-friendly textile composites
- industrial textiles
- green dyeing and finishing chemicals and processes
- energy saving and emission reduction technology
- pollution control and waste treatment
- non-water medium dyeing and finishing
- textile recycling technology
- smart textiles
- digital printing
- 3-D printing
- fundamental research and characterization techniques

Innovation, Ecology and Quality: The Pathway to the Wool Future is the theme for the IWRC. The International Wool Research Conference serves as an important exchange platform for academic experts, scientists, and engineers, as well as product developers from all over the world on wool and other related fields.

www.aatcc.org/events/China_2015_IWRC_Sustainability_Symp.htm
Southern Textile Research Conference
May 17-19
Hyatt Regency Hotel, Greenville, SC, USA

The theme of the 2015 Southern Textile Research Conference (STRC) will be *Advanced Automotive Materials, Textiles and Fibers*. This year the conference will convene at a new location—the Hyatt Regency Hotel in downtown Greenville, SC, USA. In addition to the new location, the format of the conference will change; a tour of an automotive research facility is being planned the afternoon of May 18.

For additional details, contact Ken Greeson; kgreeson@cottoninc.com

Mark Your Calendar
Make plans now for upcoming events and opportunities. For details, visit www.aatcc.org.

**March 24-26**
AATCC International Conference
Savannah, GA, USA
www.aatcc.org/ic

**March 31**
Award Nominations Due for Olney Medal, Chapin Award, Millson Award, and Young Entrepreneur Award
www.aatcc.org/awards

**June 10-12**
The 13th International Wool Research Conference & AATCC Sustainability Symposium
Zhejiang Sci-Tech University
Hangzhou, Zhejiang, China
www.aatcc.org/events

**Ongoing**
AATCC Webinar Series
www.aatcc.org/events/online/webinars.htm

UV Calibration Reference Fabric Program
www.aatcc.org/testing/improve/uv.htm

Global Test Method Training
www.aatcc.org/events/workshops/global.htm

Proficiency Testing Programs
www.aatcc.org/testing/improve/proficiency.htm

Textile Fundamentals Online Training
www.aatcc.org/events/online/fundamentals.htm
AATCC Foundation Scholarships
Applications due March 31

Applications are being accepted for the following AATCC Foundation Inc. scholarships. All scholarships are processed by AATCC Foundation Inc. Scholarship recipients receive half of the award for the fall semester, and half for the spring semester. Unless otherwise noted, all applications are due March 31, 2015.

Charles H. Stone Scholarship
The Charles H. Stone Scholarship, in the amount of US$6,000, is available for qualifying juniors and seniors majoring in textile chemistry and related fields of study at Clemson University and North Carolina State University. The scholarship committee contacts the university representatives directly for applicants.

Color Solutions International Textile and Apparel Design Scholarship
The Color Solutions International Textile and Apparel Design Scholarship is for undergraduate juniors or seniors studying textile and apparel design. The CSI Scholarship Committee will choose two recipients for this scholarship. Each recipient will receive a US$2,500 scholarship.

Charles E. Gavin III Family Scholarship
The Charles E. Gavin III Family Scholarship in the amount of US$2,500 offers scholarships to specific universities on a rotating basis. Each university in the rotation matches this scholarship, doubling the amount of the scholarship.

Metro Scholarship
The AATCC Foundation Inc. Metro Scholarship offers US$3,000 in scholarships targeted to undergraduate students pursuing a degree in a textile field at a university or college with an AATCC student chapter in the New England, New York, and New Jersey areas. The AATCC Foundation Metro Scholarship is intended for qualifying university students, based on need and academic expectancy.

The Nonwovens Institute Undergraduate Student Scholarship
AATCC Foundation, in collaboration with The Nonwovens Institute, offers The AATCC Foundation Nonwovens Institute Undergraduate Student Scholarship in the amount of US$2,500. This scholarship is offered to US citizens or permanent residents, who are currently juniors or rising seniors majoring in fiber and polymer sciences, textiles, materials science, paper science, chemical engineering, or related disciplines. The purpose is to support undergraduate students interested in pursuing graduate studies in the area of polymers, fibers, or nonwovens. The Nonwovens Institute will also cover travel and accommodations for the scholarship recipient to attend one of the Institute’s bi-annual industrial advisory board (IAB) meetings.

Scholarship applicants are required to have a minimum grade point average (GPA) of 3.0 on a 4.0 scale, must complete the application forms, and provide a four-to-five page scholarship paper (topics provided). The scholarship recipient will be required to attend one of the Nonwoven Institute’s IAB meetings in either May or November.

New Scholarship Offerings

AATCC Foundation West Region Scholarship
The AATCC Foundation West Region Scholarship is a US$2,000 scholarship intended for rising juniors or seniors pursuing an undergraduate degree in a textile or fashion-related field of study at a public college or university with an active AATCC student chapter.

AATCC Foundation Corporate Member Scholarship
The AATCC Foundation Corporate Member Scholarship is intended for the children of AATCC corporate member employees. In particular, this scholarship focuses on high school seniors who are applying for acceptance at a college or university, and plan to study textile-related topics. The scholarship recipient must attend a college or university that has an AATCC student chapter.

For additional AATCC Foundation Inc. information and applications, visit www.aatcc.org/foundation
Other student scholarships are available from AATCC Sections; for more information on these scholarships please visit www.aatcc.org/students/grants

Scholarship Winner

Member Benefits

Beginning in 2015, all recipients of AATCC Foundation scholarships, as well as recipients of AATCC
Section scholarships and AATCC Student Contest winners, will receive free student membership with AATCC for one year. If you are already a student member, your student membership will be extended for one additional year for free.

To receive your additional free year of AATCC student membership, contact Manisha Patel at AATCC Member Services; +1.919.549.3523; patelm@aatcc.org

International Conference Travel for Scholars
AATCC Foundation Inc. invites all scholarship recipients to attend the AATCC International Conference from March 24-26, 2015 in Savannah, Georgia. Student registration fees will be waived, and the Foundation will provide up to US$500 reimbursement per scholarship recipient for travel and accommodations (pre-authorization is required).

Contact Debra Hibbard, AATCC Foundation Inc.; +1.919.549.3524; hibbardd@aatcc.org

Delaware Valley Section Awards Scholarships
The AATCC Delaware Valley Section Scholarship Committee awarded two scholarships for the Fall of 2014: Miranda Elizabeth Haslam, a Sophomore attending The College of William & Mary, studying Chemistry and Biology; and Courtney Lyle, a Senior attending Philadelphia University, studying Textile Design. Congratulations to the scholarship recipients!

Miranda Elizabeth Haslam
Courtney Lyle

Journal of Research

Editor in Chief, Martin J. Bide, University of Rhode Island

AATCC Journal of Research is AATCC’s new online, peer reviewed research journal.

For more information, visit: www.aatcc.org/media/Read/Journal
A New Spin on Laundry Day

By Glenna B. Musante
Traditionally, the cycles and steps involved with doing a load of laundry have been predictable and not very complicated. But just as new technologies have changed how people work and communicate, new laundry machines and detergents have become increasingly sophisticated and complex to use.

Within the last 10 years, laundry machines have changed dramatically. This has been largely driven by regulations in countries such as the United States mandating that new machines use less energy and water than previous models. New laundry machines, and new detergents for both commercial and residential machines, have emerged to meet those mandates. This in turn has reconfigured the standard algorithm that equals a well-washed load with minimal dye bleed and fiber abrasion.
Less Water, More Issues
Since around the 1980s, says Elizabeth Easter, a professor at the University of Kentucky, energy efficiency has been “the number one driver” for both industrial and residential laundry machine design change. But now, she says, both platforms are developing machines that use less water, as well as less energy.

For both residential and commercial platforms, this means more cold water wash loads, a new generation of detergents formulated to perform in cold water, and a host of other factors impacting laundry efficiency.

In the past, a typical consumer washing machine would use from 40 to 45 gallons of water per wash load, says Celia Kuperszmid-Lehrman, deputy home editor for Consumer Reports, but today’s new machines use about half as much water. Some new models even use as little as 10 gallons of water for a load of laundry.

Commercial washing machines have always used significantly less water per pound of clothes than residential top loading washers, says Easter. “We don’t see as much of the drive to reduce the amount of water [in that market], but there is a drive to lower the temperature of [the] water.”

To that end, she adds, “we no longer see commercial laundries washing at 200° F and 180° F. Even for work wear, we have seen a reduction in the wash temperature, which basically requires some changes in the detergent industry to accommodate the removal of soils that traditionally would dissolve in higher water temperatures.”

Easter adds that in both residential and commercial laundry machines, “we see a significant increase in the extraction speed” of water during the spin cycle. In commercial machines this is referred to as G-Force. Extraction speed in consumer washing machines is typically referenced as RPMs, or revolutions per minute.

“Traditionally, we would see commercial extractors using 200 G-Force in the spin cycle,” she says, “but now we see a much higher G-force...up to 400 Gs, and sometimes beyond that.” That has led to overall energy savings, “because if you extract [moisture] at a higher spin speed, you extract more moisture from the load and clothes will dry faster in the drying operation.”

There is a downside to increased water extraction with residential laundry, she adds. Now that clothes are leaving the washing machine drier than in the past, “timed drying may [now] actually be over-drying clothes,” she says, which can result in significant surface damage.
Products that carry the DuPont Teflon fabric protector brand not only stand up to the environment, but can use less energy, less natural resources and reduce your carbon footprint.*

With Teflon fabric protector, textiles require less washing and lower wash- and dry-temperatures, which extend the life of the clothing and reduce the impact on the environment.**

Teflon fabric protector—now more sustainable than ever.

*Carbon footprint claim based on testing which demonstrates that treated products require lower wash temperatures and 25% less drying time.

**Capstone repellents for Teflon fabric protector utilize short-chain molecules that cannot break down to PFOA in the environment. Capstone repellents meet the goals of the U.S. EPA 2010/15 PFOA Stewardship Program.
A New Wash Day for Testing

With so many changes taking place, test methods for colorfastness, wash durability, and laundry efficiency will need to be adjusted to account for the changing wash day algorithm.

Says Kuperszman-Lehrman, consumers may not be up to speed on how to use the new detergents. “There’s a real need for consumers to be educated to the changes that are taking place with both machines and detergents. A re-education process is needed.”

Meanwhile, she adds, organizations such as AATCC that establish test methods for laundering will be facing a dilemma. “They need to decide whether they should base their tests on how consumers are actually doing their laundry, based on [old] laundry habits that go back to the 1980s, or create tests that are based on how the new machines and new detergents work.” The latter approach, she says, assumes consumers “are up to speed on the new machines and the new way of doing things.”

The current AATCC Test Method committees that apply to laundering include RA42, Dimensional Changes Test Methods, and RA60, Colorfastness to Washing. According to Diana Wyman, AATCC’s technical director, the accelerated laundering method previously used to reference both home and commercial applications now only applies to home laundering. Other AATCC Test Methods that apply to washers and dryers are 88B, 88C, 124, 130, 135, 142, 143, 150, 172, 179, and 188.

The current AATCC Wash Cycle for Home Laundering Machines guideline applies to US and Canadian standard top load models, and high efficiency top load machines, using a normal cycle with warm wash.

Future plans include developing test methods based on front load and international models, as well as temperature adjustments and additional wash cycles.

An AATCC committee was established to create a consistent set of laundering test conditions that reflect what are described as “changes in consumer practices in the past several years as a result of energy conservation measures and changing lifestyles.” More about this can be found in AATCC Monograph M6, “Standardization of Home Laundry Test Conditions,” dated July 31, 2013. This is AATCC’s most recent monograph on this topic.

Meanwhile, AATCC members interested in this topic are invited to join one of the relevant AATCC committees, including RA88, Home Laundering Technology.
Manufacturers are compensating for this with dryers that can sense the moisture content of a load of laundry. As Easter explains, “in sensor dry [machines] in both platforms, the dryer itself has the ability to stop before it over-dries.”

**New Consumer Laundering Trends**

Both Easter and Kuperszmid-Lehrman noted that front load machines have become increasingly popular with residential consumers. Traditionally, consumers in the United States have preferred top load washer and dryers. Today, however, front loaders account for as much as 20% to 30% of the market, Kuperszmid-Lehrman says.

Front loaders, which do not use a central rotary agitator, may also be gentler on clothes. In addition, front loaders have higher spin speeds and as a result, extract more water than top loaders. The downside, however, is that front loaders take more time to wash a load of laundry than top loaders.

Other changes on the residential side include the introduction of increasingly sophisticated computer technology that allows consumers to manage washer and dryer cycles from remote locations, including one’s work computer.

Easter says another significant laundering change is the fact that most care labels now call for washing items in cold or warm water, rather than hot. In addition, there may be more color exchange on white clothing and linens because, with fewer white items on the market, consumers may be washing the whites they own with colored laundry.

**Not Your Grandma’s Detergent**

Detergents have changed as well. Traditionally, a cup of powdered detergent was used to wash a typical load of laundry in a residential top load machine. But today’s consumers have moved away from powders. Now an estimated 75% of consumers use liquid detergents, or detergents packaged in so-called pods.

At the same time, detergent concentrations have changed significantly, with increased concentrations resulting in a reduction in quantities of both detergent and laundry additives becoming the norm in today’s consumer markets.

Detergent scents have changed as well. “The industry has done a good job of moving beyond the..."
Bottom line?

Consumers need to take the time to learn how to use today’s sophisticated machines, as well as the new detergents. Meanwhile, the industry needs to adjust its test methods to keep up with changing laundering and detergent technologies, plus figure out how to accurately assess the consumer learning curve.

Many consumers, Kuperszmid-Lehrman adds, “just want to do their laundry and get it over with and are not looking for any sort of complicated process. In other words, they aren’t reading the instructions.”

It all adds up to a complicated new laundry day.

Looking Forward

Easter and Kuperszmid-Lehrman both indicated that doing the laundry will continue to become increasingly sophisticated. The variables that go into doing a load of laundry are changing and will continue to change, she says, “as manufacturers experience pressure from regulating bodies to have improved energy [savings] and water consumption,” as well as increased consumer expectations.

The Washing Machine of the Future

This January, Whirlpool announced its next-generation Smart Top Load Washer and Dryer, which includes home and away, or remote access, controls. These controls, according to a company press release, “help prevent wrinkles and delay cycles when energy costs are high.” The company’s new top load machine can also go to quiet mode via the Whirlpool Mobile app.

Looking even further into the future, GE’s industrial design team has created a number of innovative appliance concepts for what the company calls “Home 2025.” This includes new laundering technology that looks very different from today’s technology.

Water scarcity was a leading concept for the design team behind “Home 2025,” and one of the key themes for the future was the need to reuse so-called “gray water” by both laundry and dish washers. In addition, GE’s washing machine of 2025 washes, dries, and then stores cleaned clothing in compressed pellet form, which can be revived as needed. According to material from GE, “commercial, public compressors, and revivers [will be] found on many common areas around the city.” Compressed laundry items would be designed to save space, eliminate folding, and make it easier to keep spare clothing at work or in the gym bag.

Presumably, clothing pellets would also reduce or eliminate those pesky baggage fees many airlines now charge.

doi: 10.14504/ar.15.2.1
Influence of Seam Type and Laundering on Seam Puckering and Functional Properties of Cotton/Polyester Shirt Fabrics

By Emilija Toshikj, Goran Demboski, Igor Jordanov, and Biljana Mangovska, Sts. Cyril & Methodius University

Introduction
In the garment manufacturing industry, manufacturers of dress shirts are faced with increased pressure to remain competitive in worldwide global markets. The ability to compete depends mainly on productivity and quality. Manufacturers establish quality standards of a particular level for dress shirts.

Dress shirts of different quality levels serve different purposes. Not all dress shirts must be of the highest quality, but a dress shirt should be of the highest quality for which the customer is willing to pay. Each item must be consistent with other similar products in its product line and must provide adequate quality and performance to ensure product serviceability.

Mens dress shirts include a diversity of styles, types, volume of production, colors, and designs, as well as constructions. Dress shirts of the same style and size produced by different manufacturers should satisfy defined standards and are rejected if customer specifications are not met.

Processes involved in dress shirt assembly include various operations, such as attaching collar, cuffs, yoke, pockets, placket, and hemming. Small components are attached to the larger parts, and larger parts are assembled with different types of seams, each seam having a distinctive performance. Seam types depend on the method of assembling, materials used, predetermined quality level, performance expectations, cost limitations, available equipment, and aesthetic requirements.

Dress shirts are usually made from woven fabrics of natural fibers (e.g., cotton, linen, wool, and silk), or synthetic fibers (e.g., polyester or polyester blends). Common dress shirt fabrics are broadcloth, twill, poplin, Oxford, and end-on-end patterns. More exotic types of weaves are applied to shirt fabrics for formal, casual, and sportswear styles.

Selecting the appropriate fabrics is only the first step in dress shirt manufacturing. Acceptable fabric quality is based on aesthetic and performance needs for particular styles. It is often difficult to evaluate the quality of a material. Expert skills for subjective evaluation of fabric quality are developed with experience. Fiber content, yarn count, fabrication, fabric weight, hand and drapeability, fabric structure and/or applied design, colors, finishes, and care properties are features that contribute to aesthetics, performance, and fabric quality. Inherent properties of textile fibers determine the fundamental performances of fabrics and shirts.

Overall shirt appearance depends on the purpose of the shirt, fabrics, quality of seams, and final assembly and finishes. Conversion of a 2-D fabric into a 3-D garment involves selection of a suitable fabric and optimization of sewing parameters that yield adequate seam and garment performance during wear and care. The relationship between material properties, sewability, and seam quality becomes very important.

Apparel companies are concerned about fabric properties, because the fabric influences not only dress shirt quality, but also the ease with which a shell structure can be produced out of flat fabric. Materials must be compatible within each garment, with assembly procedures, and with performance expectations.

Fabric properties that affect apparel seam quality are weight, thickness, strength, shrinkage, and functional finishes, as well as extensibility, bending rigidity, and shear rigidity (i.e., some of the parameters that form an integral part of low-stress mechanical properties). Good quality seams are a basic requirement in apparel construction. The overall quality of a seam depends on its performance (e.g., strength, elasticity, durability, stability, and appearance). Factors influencing seam performance are fabric type, seam type, sewing thread, stitch type, and density. Defective seams may ruin the garment appearance and can be the cause of ultimate failure and rejection.
For proper appearance, the seam should not contain any defects including skipped stitches, unbalanced stitches, seam grin, distortion, unevenness or puckering, unsteadiness, uneven seam density, and yarn severance or damage.\(^8\)

Evaluation of seam pucker is one of the most important aspects for quality control in the shirt manufacturing industry.\(^9\) At present, seam pucker evaluation is mainly carried out by human inspectors, which is subjective, unreliable, and time-consuming. Seam pucker leads to aesthetically unacceptable garments and may also cause inconvenience in wear.

However, fabric and seam quality are not the only criteria for the production of high quality dress shirts. Apparel consumers also pay attention to appearance, comfort, and fabric hand and evaluate seam quality based on the seam appearance and its mechanical intactness after wear and care.

In the lifetime of a dress shirt, both fabrics and seams undergo repeated laundering, which may affect the quality and performance of the sewn dress shirt. Laundering process factors include textile materials, soil, water, detergents, and washing machine. Generally, washing is more damaging to fabric than its usage or wear.\(^\text{10}\) Detergents and washing processes should not only be tested for their cleaning efficiency, but also for their gentleness to dress shirts during laundering. Laundering conditions such as temperature, the number of laundering cycles, type of detergent, and concentration of washing products are known to influence changes in textile hand, hydro properties, surface friction, and other properties.\(^\text{11−13}\)

In recent years, many researchers have been working on the influence of fabric properties on seam pucker to predict puckering appearance on the basis of fabric properties, especially structure and mechanical properties, not only after sewing but also during shirt use and care. Under normal wear conditions, the material is relaxed. Since textile materials have nonlinear mechanical properties, and different materials react differently to strain, it is important to look into the relationship between fabric mechanical properties and their behavior.\(^\text{14}\)

During sewing, fabric is subjected to various mechanical stresses (e.g., shear, compression, and extension), which affect shirt performance. Also, the fabric properties under low loads (e.g., strength, thickness, and compression that govern its sewability) are important to seam appearance and performance. Since there are various types of seams, garments with different seam types may behave differently after the sewing process. Seams are evaluated by manufacturers during the fabrication process. After sewing, elastic deformations slowly disappear, but some stresses in the fabrics remain.

The aim of this investigation was to estimate the influence of seam type, laundering, and detergent type on a seam puckering, and on wearable, aesthetic, and comfort properties of cotton/polyester woven mens shirts.

### Experimental

#### Materials

Ten commercially-available white woven (plain weave) fabrics for production mens dress shirts, of various weight and polyester and cotton blend composition, were seamed using three conventional types of seams: a safety seam (504.401)-EFd-1-SSa-1 (Seam Type A), a double lap or French seam 401-LSc-2 (Seam Type B), and seam type SSw (Seam Type C) (English seam), which is produced in two stages (Fig. 1). Woven fabrics in blends of 33:67, 65:35, 45:55, 50:50 polyester (PET)/cotton were appropriate for dress shirt, sportswear, and bed linen production. These blends were soft, absorbent, do not shrink or shrink very little, and do not crease easily. Thus, manufacturing of these blend combinations had more practical than aesthetic value. The characteristics of the fabrics are shown in Table I.

The seams were prepared according AATCC Test Method (TM) 88B-2006\(^\text{15}\), from 300 × 300 mm

---

**Fig. 1. The types of seams used in investigations.**
fabric specimens in the warp direction. Sewing was done on an industrial sewing machine under sewing parameters commercially adopted by apparel manufacturers. The sewing parameters and machine settings were constant during the sewing of various seam types.

Half of the samples, with seams and without seams, were washed with powder (A) detergent, and the other half with liquid (G) detergent for three cycles in an automatic washing machine. These detergents were commercially-available and had very different formulations. Powder detergent A contained 5-15% anionic surfactant, 5% nonionic surfactant, phosphate, oxygen bleaching agent, enzymes, poly-carbonates, soap, zeolites, optical brighteners, and fragrances. Liquid detergent G contained 15-30% anionic surfactant, formaldehyde, fragrance, benzyl benzoate, 2-(4-tetra-butylbenzyl) propyl aldehyde, coumarin, hexyl aldehyde, and linalool. After laundering, the samples were dried in a vertical direction at room temperature (RT). The washing machine was set as follows: total load weight of 1.8 kg, water level high, 60 °C for washing, 106 min washing time, and a 40 L water content. The structural, mechanical, aesthetic, and comfort properties of fabrics, and seam thickness and puckering, were investigated before and after the third washing cycle with two different detergents. Fiber composition was analyzed according AATCC TM 20A-2005, Fiber Analysis: Quantitative.\textsuperscript{16}

Structural properties were determined using:
- fabric weight (g/m\(^2\)) according to BS 2471 1978, ISO 3801:1977
- warp and weft densities (cm\(^{-1}\)) according to TS 250 EN 1049-2 and TS 250 EN 1049-2, respectively
- fabric thickness, according to TS 7128 EN ISO 5084 on Mesdan LAM instrument
- linear density, according to ISO 7211/5
- shrinkage (%) during laundering was estimated according to EN 25077:1996 by measuring the samples before and after laundering

\[
S = \frac{L_0 - L}{L_0} \times 100 \quad \text{Eq. 1}
\]

\(L_0\) is the distance between mark lines before laundering and \(L\) is after laundering.

Mechanical properties were determined by measuring tensile strength and elongation according to the BS EN ISO 13934:1-1999 test method on a Tinus Olsen tensile tester, using a test speed of 100 mm/ min and a gauge length of 200 mm. Fabric stiffness was determined according to ASTM D4032-94 on a M003F digital pneumatic stiffness tester.

Aesthetic properties were determined using drape coefficient (%) according to BS 5058:1973.

Comfort characteristics were determined using air permeability (L/m\(^2\)/s) according to BS EN ISO 9237:1995 on a M021A air permeability tester using a test area 20 cm\(^2\) and pressure 100 Pa, and water vapor permeability (g/m\(^2\)/day) according to BS 7209:1990.

<table>
<thead>
<tr>
<th>No.</th>
<th>Declared Fiber Composition PET:Cotton</th>
<th>Analyzed Fiber Composition PET:Cotton</th>
<th>Fabric Weight (g/m(^2))</th>
<th>Linear Density (tex)</th>
<th>Shrinkage After Laundering (%)</th>
<th>Powder Detergent A</th>
<th>Liquid Detergent G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Warp</td>
<td>Weft</td>
</tr>
<tr>
<td>1</td>
<td>33:67</td>
<td>33.44:66.56</td>
<td>76.93</td>
<td>11</td>
<td>7.2</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>65:35</td>
<td>59.05:40.95</td>
<td>81.57</td>
<td>9</td>
<td>17</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>45:55</td>
<td>37.50:62.50</td>
<td>103.40</td>
<td>12.5</td>
<td>12.5</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>50:50</td>
<td>37.35:62.65</td>
<td>108.90</td>
<td>12.5</td>
<td>12.5</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>50:50</td>
<td>44.88:55.12</td>
<td>112.95</td>
<td>14</td>
<td>14</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>6</td>
<td>45:55</td>
<td>41.55:58.45</td>
<td>114.33</td>
<td>14</td>
<td>14</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>7</td>
<td>100 PES</td>
<td>95.24:4.76</td>
<td>129.58</td>
<td>20</td>
<td>20</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>8</td>
<td>50:50</td>
<td>47.85:52.15</td>
<td>134.14</td>
<td>20</td>
<td>20</td>
<td>3.0</td>
<td>0.5</td>
</tr>
<tr>
<td>9</td>
<td>45:55</td>
<td>42.36:57.64</td>
<td>134.40</td>
<td>17</td>
<td>20</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>10</td>
<td>65:35</td>
<td>65.21:34.79</td>
<td>149.75</td>
<td>34</td>
<td>42</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Garment appearance properties were determined using seam thickness (mm) according to TS 7128 EN ISO 5084 and on a Siro FAST-1 compression meter instrument for measuring fabric thickness, and seam puckering according to AATCC TM 88B-2006, Smoothness of Seam in Fabrics after Repeated Home Laundering.15

Results and Discussion
Fiber Composition and Weight
The results of analyzed fiber compositions and linear densities of warp and weft yarns in the blended test fabrics are presented in Table I. Fabrics 1 and 10 met specifications regarding fiber composition, Fabrics 6–9 met specification within tolerance, while Fabrics 2–5 did not. All fabrics had asymmetric fabric structures with higher thread density in the warp direction. Fabric weights ranged from 76–150 g/m², so there was twice the difference in fabric weight between lightest and heaviest fabric (Table II). Different fiber compositions and weights influence the structural, mechanical, aesthetic, and comfort properties of the fabrics before and after laundering, as well as on seam puckering.

Seam Puckering and Thickness of Referent Fabrics
Table III shows subjective evaluations of seam puckering of Seam Types A–C before and after the third laundering with two detergents according to AATCC...
TM 88B-2003. Grade 5 represents the best level of seam appearance, and grade 1 the poorest level.

Data from Table III show that there are differences in seam thickness of the three analyzed seams, which is the result of seam type geometry. The greatest seam thickness was observed for Seam Type C, less for Seam Type B, and the least for Seam Type A. Seam thickness and seam puckering within one type of seam also varied. There was no correlation between thickness and puckering for Seam Types C and B, but some dependence was noticed for Seam Type A—fabrics with greater seam thickness showed less puckering.

Seam puckering is largely influenced by fabric structure and properties including fabric thickness and rigidity; thicker and more rigid fabrics crease less. For referent fabrics and Seam Type A, the increase in fabric weight resulted in less puckering (Table III). There was a correlation between fabric weight and pucker for referent samples and Seam Type A, but not for other types of seams and treatments. Fig. 2 shows average values of seam pucker for three seam types. Seam Types A and B showed very close average seam pucker values. Seam Type C performed better compared to Seam Types A and B and gave higher pucker grades (less puckering). The analysis of variance (ANOVA) proved that the seam type did not significantly influence puckering for the referent samples, which were unwashed.

### Dimensional Stability and Seam Puckering after Laundering

Fabrics with three different seams were laundered three times with two detergents having different formulations. The degree of fabric shrinkage was analyzed and the results given in Table I. Shrinkage of the laundered fabrics with various detergents both in the warp ($S_{warp}$ = 1–4%) and weft ($S_{weft}$ = 0.5–2.5%) directions was, for the most part, not remarkable. After laundering, all fabrics showed greater shrinkage in the warp direction. Six out of ten samples showed the same shrinkage regardless of detergent type used. Two fabrics showed greater shrinkage when using liquid detergent G, while two other fabrics showed greater shrinkage using powder detergent A (Table I).

Greater shrinkage in the warp direction was expected due to stress applied on the warp yarns during the weaving and finishing processes. Problems may arise when shrinkage exceeds 3%. Of all analyzed fabrics, only Fabric 1 showed greater shrinkage than 3%. This fabric had the highest cotton content (67%). In all other cases, shrinkage was lower than 3% (Table I). Fabric weights of the analyzed fabrics increased after laundering from 0.8% to 9.39%, as a result of water, temperature, and detergent treatment (Table II). These structural characteristic changes in the laundered fabrics influenced seam puckering.

Differences in puckering behavior with various seam types were noticed on laundered samples using powder detergent A (Fig. 3). As opposed to the referent samples case, Seam Type A now performed best and had the greatest pucker value, followed by Seam Types C and B, which had the lowest pucker grade (worst puckering). Seam Type A consisted of one row of stitches and caused the least material distortion. Seam Type B consisted of two close rows of stitches and more layers of material into the seam cross section (Fig. 1). Due to its geometry, Seam Type B was more prone to puckering. Seam Type C also had more rows of stitches, two parallel in the
first stage and an additional one in the second stage. Less puckering of Seam Type C compared to Seam Type B can be attributed to a longer distance between the first two rows of stitches in the seam cross section. Analysis of variance (ANOVA) confirmed that seam type was the influencing factor for seam puckering after laundering with powder detergent A (Table IV).

Like the laundered samples with powder detergent A, the results of the seam pucker for the samples laundered with liquid detergent G (Fig. 4) also showed less puckering for Seam Type A, followed by Seam Types C and B. Again, ANOVA confirmed that seam type was a significant factor for seam puckering after laundering with liquid detergent G (Table V).

The influence of the laundering process with powder detergent A and seam types on seam puckering is shown in Fig. 5. The increase of seam puckering from referent samples to laundered samples was more obvious for Seam Types B and C. Seam Type A was not affected by washing with powder detergent A. ANOVA confirmed that the laundering process with powder detergent A and seam type and their combined effect were significant factors to seam puckering (Table VI).

The effect of laundering using liquid detergent G on seam puckering is shown in Fig. 6 and Table VII. When treating with liquid detergent G, Seam Type A showed a slight increase of puckering, whereas with detergent A, no additional puckering was observed.

If the influence of detergent type and seam types on seam pucker is analyzed (Fig. 7), no significant difference in puckering was observed after washing with powder detergent.
Heat setting of the fabrics after many mechanical, wet treatments, and calendaring flattened the yarns into an elliptical form. Wet relaxation, during several laundering processes, caused fiber swelling, increased yarn crimp (weave crimp), and changed the cross shape of the yarn to a circular one. The increase of yarn crimp in the washed fabric led to the increased shrinkage (Table I), increased fabric thickness (Table II), and increased tensile extensibility and fabric stiffness (Table IX). Samples treated with powder detergent A showed greater fabric stiffness than liquid detergent G treated samples. Liquid detergent G treated samples showed greater tensile extensibility compared to referent and powder detergent A treated samples, indicating a greater interaction.

A and with liquid detergent G. ANOVA proved that the significant factor was seam type. Detergent type and combined effect of seam types and detergent type were not significant factors (Table VIII).

ANOVA shows that seam type did not significantly influence puckering for referent samples, while seam type significantly influenced puckering after laundering with powder A and liquid G detergents (Tables IV-V). It also shows that detergent type did not significantly influence seam puckering (Table VIII). The differences in puckering between laundered samples with both detergent types can be explained by the fact that dress shirts undergo quality changes during repeated laundering. Next, other quality changes after laundering were analyzed using structural, mechanical, and comfort properties of fabrics before and after laundering.

**Fabric Structural, Mechanical, and Comfort Properties**

Heat setting of the fabrics after many mechanical, wet treatments, and calendaring flattened the yarns into an elliptical form. Wet relaxation, during several laundering processes, caused fiber swelling, increased yarn crimp (weave crimp), and changed the cross shape of the yarn to a circular one. The increase of yarn crimp in the washed fabric led to the increased shrinkage (Table I), increased fabric thickness (Table II), and increased tensile extensibility and fabric stiffness (Table IX). Samples treated with powder detergent A showed greater fabric stiffness than liquid detergent G treated samples. Liquid detergent G treated samples showed greater tensile extensibility compared to referent and powder detergent A treated samples, indicating a greater interaction.
fabric structural parameters (e.g., fabric weave, fiber composition, and yarn set). Results from Table IX indicated decreased air permeability with an increase in fabric weight. Light fabrics such as Fabrics 1 and 2 had very high air permeability. For dress shirt fabrics, it is very important that the fabric be actively ventilated. In all examined samples, air permeability decreased after laundering. Greater decrease was observed after laundering with liquid detergent G when compared to laundering with powder detergent A. This was due to a greater degree of swelling, greater fabric weights, and probably formation of smaller pores after laundering with detergent G. Fabric weight, fabric thickness, and fabric elongation increased after laundering with either detergent. The increase of fabric weight and elongations was greater in samples laundered with liquid detergent G than with powder detergent A, suggesting more intensive changes to the shape and number of pores. Materials that are permeable to air are also, in general, likely to be permeable to water, in either the vapor or the liquid phase. The water vapor permeability before laundering in most cases was lower compared with the water vapor permeability of laundered fabrics with liquid detergent G. Opposite results were observed on fabrics laundered with powder detergent A (Table IX).

**Conclusion**

Seam type and laundering significantly affected seam puckering, irrespective of detergent type. Laundering, besides generally increasing seam puckering, induced differences in seam puckering.
between analyzed seams independent the detergent type. Seam Type A after laundering showed the least puckering, as a result of seam geometry, followed by Seam Types C and B. Detergent type affected structural, mechanical, aesthetic and comfort properties of shirting’s woven fabrics. Fabrics laundered with the powder detergent used in this study showed slightly greater increase of fabric thickness, stiffness, water-vapor permeability, and air permeability, when compared to fabric laundered with the test liquid detergent. These changes were also related to the seam type, and properties and qualities such as seam thickness and seam puckering. Understanding behavior of seam quality helps in planning and controlling dress shirt quality at the time of sewing and laundering.

References

Author
Emilija Toshikj is a junior teaching assistant in the Textile Technology Department at Sts. Cyril & Methodius University. Her research interests are in the areas of the clothing industry and textile care with different detergent formulations and their influence on garments.

Emilija Toshikj, Sts. Cyril & Methodius University, Faculty of Technology and Metallurgy, Dept. of Textile Technology, Ruger Boskovic 16, PO 580, Skopje, Macedonia; phone +38.923.088246; tosic_emilija@tmf.ukim.edu.mk.
Off Gas Measurements from FR Materials Exposed to a Flash Fire

By Mark Ackerman, Jane Batcheller, and Stephen Paskaluk, University of Alberta

Abstract
The decomposition of flame resistant (FR) materials, either through elevated temperature or contact with flames, results in a range of chemical species, some of which can be quite toxic to humans. Small scale or bench scale tests for decomposition products have been done in the past, but there were always questions as to whether these were representative of full-scale flash fire test results. To determine whether the decomposition products would be of sufficient quantity to measure and whether different FR materials would produce a “signature” set of compounds, full scale testing was undertaken. Coveralls constructed from four common FR materials were evaluated. The methodology used allowed the determination of the thermal decomposition products of FR materials when exposed to flash fire.

Key Terms
Acids, Aramids, Cotton, Decomposition, Fire, Flame Resistance, Gases, Lyocell, Modacrylics, Protective Textiles, VOC

DOI: 10.14504/ajr.2.2.1

Study on Charge Distribution of Carboxymethylated Cotton Fabric by Streaming Potential/Current Measurements

By Zhengjia Wang, Peter J. Hauser, and Orlando J. Rojas, North Carolina State University

Abstract
Carboxymethylated cotton might provide an eco-friendly, novel approach to impart different functions to fabric by crosslinking or self-assembly deposition of nanolayers. The anionic content of carboxymethylated cotton was determined by acid-base titration. Two interrelated methods of surface electrochemistry for anionic cotton fabrics were investigated in this paper. Measurement of surface charge on carboxymethylated cotton was achieved by characterizing the zeta potential of the anionized fibers via streaming current (SC) and fiber-pad streaming potential (SP) measurements, which showed only a small percentage of total
charges contributed to the surface charge. SC and SP methods were proven to be useful in studying the surface charge of ionic cellulose.

**Key Terms**
Carboxymethylated Cotton, Streaming Current, Streaming Potential, Surface Charges, Total Charges

**DOI**: 10.14504/ajr.2.2.2

**Review: Potential Use of Plant Proteins and Feather Keratin as Sizing Agents for Polyester-Cotton**

By Narendra Reddy, Jain University and Yiqi Yang, University of Nebraska-Lincoln, Lincoln

**Abstract**
This review assesses the potential of using plant proteins (wheat gluten and soy proteins) and chicken feather keratin as sizing agents for polyester/cotton (P/C) fabrics. Sizing (slashing) is a critical and essential process required for weaving fabrics. Poly(vinyl alcohol) (PVA) is a traditional size for P/C yarns since PVA readily dissolves in water, provides good sizing performance, and is easily desizeable. However, PVA released from textile effluent treatment affects water organisms. Protein-based sizes required higher percent add-on to provide strength similar to PVA, but had excellent desizing, even at room temperature using low liquor ratios. Similarly, protein-based sizes degraded easily in activated sludge with COD and BOD₅ values well within the prescribed limits. Plant proteins and feather keratin show promise to replace PVA for sizing P/C fabrics.

**Key Terms**
Biodegradation, BOD, Cotton, COD, Feathers, Gluten, Keratin, Polyester, Proteins, PVA, Sizing, Soy, Waste Water

**DOI**: 10.14504/ajr.2.2.3

**Sustainable Coloration of Jute Fabric using Natural Dyes with Improved Color Yield and Functional Properties**

By S. N. Chattopadhyay, N. C. Pan, A. K. Roy, and A. Khan, National Institute of Research on Jute and Allied Fibre Technology, Indian Council of Agricultural Research; and B. Das, University of Calcutta

**Abstract**
Jute is a renewable, biodegradable, and lignocellulosic natural fiber traditionally used for making packaging material. Due to the environmentally-friendly nature of this fiber, it is now used for making diversified and value-added products including upholstery, home furnishing textiles, handicraft items, soft toys, and even apparel. Jute fabric was dyed with natural dyes extracted from manjistha, annatto, ratanjot, and babool by a pre-mordanting method. Dye extraction conditions were standardized and applied on pre-mordanted jute fabric. There was a substantial improvement of color yield, levelness of dyeing, and washfastness properties of naturally dyed jute fabric after double pre-mordanting using bio-mordants and inorganic mordants. Lightfastness (moderate to good), crockfastness (very good to excellent), and UV protection (very good) ratings were determined, as well as antimicrobial activity.

**Key Terms**
Fastness, Jute, Mordants, Natural Dyes, Sustainability

**DOI**: 10.14504/ajr.2.2.4
AATCC’s Textile Trivia Game: Let’s Play!

Try Your Wits in AATCC’s Textile Trivia Game

AATCC members have gathered fascinating bits of textile and apparel trivia over the years. On the aatcc.org website, we’re hosting a monthly textile trivia game, so that you can test your wits against other AATCC members.

Look for new questions, and the previous month’s answers, in AATCC Review, in AATCC News, on the AATCC App, and on the aatcc.org website! Every month, we’ll acknowledge the Trivia Masters from the previous month, as well as the person who submitted that month’s brain teaser. If you answer the trivia question correctly before the deadline, your name will be entered in a drawing for a US$25 Amazon Gift Card!

Are YOU a trivia pro? If you supply us with new trivia questions and their answers, and if we use your question in the game, we’ll enter your name in the drawing as well.

Our really smart members have teased us that we need to make the trivia questions harder. What do you think? Let us know at media@aatcc.org.

AATCC Textile Trivia Question 103

When the perceived color of a material changes under different light sources, this phenomenon is known as:

☐ metamerism  ☐ color adaptation  ☐ color inconstancy  ☐ photochromism

- Thanks to Ann Laidlaw for submitting this textile trivia question!
- Submit answers and your contact information to media@aatcc.org
- Deadline for answers: March 31, 2015

AATCC Textile Trivia Question 104

Visit www.aatcc.org/trivia_game to see the next question!

- Submit answers and your contact information to media@aatcc.org
- Deadline for answers: April 30, 2015
- This is the last trivia question before the prize drawing during the Spring Committee Meetings in May—don’t miss your last chance to play!

AATCC Textile Trivia Game Rules

When you send in your answers, you must include the Question Number, your answer, and your contact information (in case you win a prize!). We promise not to sell your contact information.

For detailed game rules (i.e., the small print), visit www.aatcc.org/trivia_game
Be Part of AATCC Review!

If you have expertise on an upcoming feature topic, we’d love to hear from you. Please contact us as soon as possible to arrange an interview.

Maria Thiry
thirym@aatcc.org
+1.919.549.3458

See a topic that matters to your customers? They’re reading AATCC Review. Make sure they see your ad when they do.

www.aatcc.org/media/advertise
Chris Shaw
shawc@aatcc.org
+44.1270.522130
+1.919.549.3547

If you have expertise on an upcoming feature topic, we’d love to hear from you. Please contact us as soon as possible to arrange an interview.

Maria Thiry
thirym@aatcc.org
+1.919.549.3458

Ad Index

<table>
<thead>
<tr>
<th>Year/Issue</th>
<th>Feature Topic</th>
<th>Interview Deadline</th>
<th>Ad Order Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>May/June</td>
<td>Automotive Textiles</td>
<td>2/5/15</td>
<td>3/27/15</td>
</tr>
<tr>
<td></td>
<td>Smart Textiles in Medical Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July/August</td>
<td>Color Psychology and Trends</td>
<td>4/6/15</td>
<td>5/29/15</td>
</tr>
<tr>
<td></td>
<td>Natural Dyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept/Oct</td>
<td>Chemicals of Future Concern</td>
<td>6/5/15</td>
<td>7/29/15</td>
</tr>
<tr>
<td></td>
<td>Recycled Textile Fibers/Fibers Made from Waste Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov/Dec</td>
<td>Textile Flammability Regulatory Issues</td>
<td>8/6/15</td>
<td>9/25/15</td>
</tr>
<tr>
<td></td>
<td>Latest Innovations in Textile Flame Retardants</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ad Index

AATCC ....................................................... 9, 14, 33
Archroma* .......................................................... 7
Copyright Clearance Center ................................. 49
Cotton Incorporated* ............................................. 3
DuPont Teflon Fabric Protector* ......................... 37
DyStar Group* .................................................... Cover 4
Huntsman Textile Effects* .................................. 5
Q-Lab Corp.* ..................................................... Cover 2
SDL Atlas* .......................................................... 39
*AATCC Corporate Member

The AATCC App!
Download the free AATCC App to your iPhone or Android phone.

Find us on...
Brand Color Management
Consistency across substrates and vendors

Solutions to globally manage brand colors across substrates and vendors
✓ Physical and digital standards
✓ Master electronic standard
✓ Distribution and traceability through website
✓ Web-based color management
✓ Dedicated customer service representatives

www.CSIColorManagement.com/brandcolors

Committed to Sustainability

CSI is a registered trade mark in USA of DyStar L.P., and a member of DyStar Textile Services (DTS). DyStar and econference are trade marks of DyStar Colors Distribution GmbH