Phenom excels as a teaching tool at North Carolina State University

Trains Future Textile Engineers and Scientists

The Textile Engineering, Chemistry, and Science (TECS) Department of the College of Textiles at North Carolina State University (NCSU) provides undergraduate education and research, plus graduate-level research opportunities in polymers, fibers, and textiles.

Dr. Russell Gorga, program director of textile engineering

"We have moved our Phenom SEM out of the research lab and into our undergraduate teaching laboratory – allowing us, in real time, to grab a sample and project the image up on a huge classroom screen for the entire class to see."

Through teaching, research, and outreach, the Textile Engineering, Chemistry & Science Department at North Carolina State University, in Raleigh, N.C. is dedicated to advancing chemistry, color science, and engineering of polymers, fibers, and textiles.
www.tx.ncsu.edu

Today the TECS Department is an exciting place to be a student. TECS teaches undergraduate classes in polymer and color chemistry, textile technology and textile engineering, which are important in:

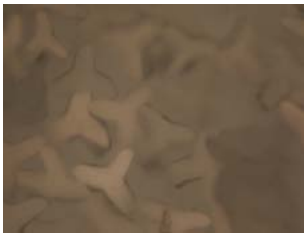
- Solving crime and settling commercial disputes
- Detecting and identifying fiber surface contaminates and adulterants to determine the mechanical and chemical "history of a fiber"
- Designing materials capable of improving batteries, photovoltaic cells, and membrane fuel cells

The college's nanofiber capabilities help train the next generation of scientists and engineers who are researching non-woven structures. The new materials find medical use as tissue scaffolds, anti-microbial surfaces, and for filtration applications. New nanocomposite materials are developed for deep space exploration. Clothing and sensors are studied for potential defense against chemical and biological warfare agents.

Challenge

When teaching fiber identification and forensics it is important to show students small differences in fibers from different sources so they can distinguish fibers that are similar in appearance. A key part of learning involves the ability to show students in real-time how to detect fiber adulterants and contaminates to determine mechanical or chemical history.

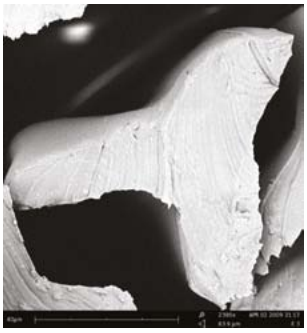
In fiber research, scientists need a method to quickly make adjustments in materials and processes for electro-spinning and nanoweaving. Research depends upon distinguishing details that look like a "homogenous blob" when viewed with an optical microscope. Laboratory scanning electron microscopes (SEMs) can view nonwoven materials, but are expensive and not readily available. To make learning more dynamic, Dr. Jon P. Rust, Professor and Department Head of TECS, and Dr. Russell Gorga, Assistant Professor and Program Director of Textile Engineering, looked for creative alternatives to optical microscopes.



Trilobal:
optical image at 400x

Trilobal nylon:
optical image at 100x

Trilobal wideangle:
Phenom at about 400x



Trilobal closeup:
Phenom at about 2500x

Why Phenom™

NCSU chose Phenom™ because it is compact, efficient, and cost-effective. “It increases what you can do in the classroom – like change samples quickly – creating immediate ‘teachable moments’ for students,” says Gorga. “We project the Phenom’s images in real-time via overhead projector to a huge screen, which you can’t do using a delicate lab SEM.”

“We teach fiber identification. We have some very nice optical microscopes but the problem is they only take you so far. We wanted to expand our range of magnification from hundreds of times magnification with the optical microscopes, and go up to thousands of times magnification range with the Phenom SEM,” says Gorga.

“We needed to show students details about natural and synthetic fibers that you are not able to see using optical microscopes.”

The Solution

The Phenom is rugged, has a quick sample load time, with resolution to 30 nm. “We were able to install it in the classroom and use it as an amazing teaching tool,” says Rust.

In fiber identification and forensics, “We get great high-resolution images of natural and man-made fibers – you see many details with the Phenom that you aren’t able to see with an optical microscope,” says Rust. “For instance, scales on human hair are difficult for many students to discern using an optical microscope and are easily seen using the Phenom.”

The Phenom allows students to distinguish small differences in fibers, allowing identification of different sources, and detection of adulterants or contaminates. The Phenom can also help determine the mechanical or chemical history of a particular fiber – important in solving a crime or resolving a commercial dispute.

In electro-spinning research applications, the NC State College of Textiles uses the Phenom to see “if we are getting nice uniform (nano) fibers.” Non-woven structures mimic body cell production in terms of laying down structures that are useful for making tissue scaffolds and anti-microbial surfaces - also used for filtration type applications. “The Phenom is a great way for my graduate students to quickly view what is going on when we are making different changes to materials and to the process. The Phenom allows us to quickly see if we are producing a fiber structure or not,” says Gorga.

The Result

“The story is as simple as one, two, three,” concludes Rust. “One, the Phenom has improved undergraduate education by taking the SEM out of the lab and putting it into the classroom for an entire class to see. Magnifications at 7000x, provide awe-inspiring moments for all our students. Two, the Phenom benefited our forensics program by not having to bear the expense of a traditional lab SEM. And, three, the Phenom improved the efficiency of research by allowing our students to walk out of our nonwoven production facility and be able to check a sample immediately and not have to wait until next week to schedule a lab SEM.”

Where will TECS’s students go next? Perhaps they will develop artificial organ tissue, design clothing to repel chemical and biological contamination, or engineer the next revolution in membrane fuel cells. Whatever careers these TECS students choose, their learning curve is accelerated by the Phenom.

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