Textile engineers make advanced materials for clothing and much more.

BY SARAH WEBB

hat do stain-resistant shirts and air bags for space landings have in common? More than you might think. Both are

examples of technical textiles, high-tech materials that are showing up in all kinds of products.

tech talk

Textiles include the fabrics we use to make weatherproof clothing, bedsheets, and upholstery. But even everyday clothing is becoming more high-tech. Do you have a fleece jacket? Textile engineers designed the fleece fabric to be lightweight and to trap heat to keep you warm. Some clothing companies now sell shirts and pants that resist wrinkles, breathable rain gear, and socks that ward off foot odor. This year a scientist figured out how to include wires in fabric that produce electricity as the fabric moves. Someday you could have a shirt that works as a power generator! Textiles are more than cloth. They can be made of any material that forms fibers that can mesh together. The flexible, high-tech materials turn up in medical devices, patches for leaky plumbing, and space suits. With so many applications, high-tech textiles offer opportunities for careers at the cutting edge of new product development.

A scientist tests a microfiber nanogenerator in which two fibers rub together to produce a small electrical current. Many pairs of the fibers could be woven together to produce a "power shirt."

## **Studying the Tiniest Fibers**

One way to get involved in high-tech textiles is to study the chemicals that make the fibers. Wendy Krause works as an assistant professor in North Carolina State University's College of Textiles. But in college and graduate school, she studied chemistry. She became an expert on long, thin molecules called polymers. "They're shaped a lot like spaghetti," Krause explains. When you bunch polymers up in mats that look like strands of spaghetti woven together, they form textiles.

The tiny fibers that Krause makes are called nanofibers. One nanofiber is thousands of times smaller than a human hair—so small that you can't even see it with a typical microscope. The tangled mats of super-small fibers can have special properties. Using different polymers and sizes of fibers, the mats can solve different problems. Some of the fiber mats resist heat and chemicals, and can be used to make safer firefighter gear, she says.

Some polymers can resist bacteria. These textiles might provide a way for scientists to grow tissues for skin grafts. Using grafts grown on nanofibers, doctors could patch damaged organs or blood vessels.

#### **Building Better Textiles**

Chuck Haryslak is plugging leaky holes. He's also a textile engineer at Polartec in Lawrence, Mass. Haryslak recently worked on a textile that could help workers repair sewage pipes without digging them up. "You have a hole, and you don't want to replace the whole pipe," he says. "You can put something in there that can create a tube and then harden." The tubular patch fits snugly inside the curves and bends of the pipe to plug the leak.

He also works on fleece fabrics that go into new clothing. If a clothing company wants lightweight, breathable fleece that will layer well, Haryslak works with his team to figure out the design and select the yarn that they will use to make the new textile. He also supervises product testing to make sure the new product is strong and doesn't wear out quickly.



Haryslak enjoys working on products people will use in their daily lives. "I feel like I produced something that people are wearing to serve a need," he says.

### **Space-Age Fabrics**

Polymers are also important for the work that Thad Fredrickson does at ILC Dover in Frederica, Del. A material development manager, Fredrickson manages a group of chemists, chemical engineers, and textile engineers who make products for NASA and the

# Swimming in Technology

Futuristic fibers are hitting the pool! This year, Speedo introduced the Fastskin LZR Racer, which the company says is "the fastest swimsuit ever created." The fabric is built to reduce surface friction drag as a swimmer moves through the water. Swimmers in Olympic trials set speed record after speed record in the high-tech suits.

Olympic swimmer Michael Phelps takes the Speedo Fastskin LZR Racer for a swim.

United States Department of Defense. For example, an astronaut has to be able to move around but not lose air out of his or her suit. The suit needs to be made of fabric that can bend and scrunch, but is still airtight. So engineers coat the textile with polymers.

ILC Dover's textiles have traveled to Mars. Before NASA could land a rover on Mars in 1996, scientista had to figure out how to get the robot onto the planet safely. NASA decided to land the rover like a beach ball. The robot would be covered in air bags as it fell through the atmosphere and bounce as it landed on the surface. Fredrickson and his team designed the textiles for those air bags.

There were many challenges. The air bags had to pack tightly around the rover into a space about the size of a car and then expand when it was time to land on Mars. The material needed to be extremely strong, so that it wouldn't rip on the martian rocks. The fabric also needed to stay flexible in the cold martian temperatures and couldn't contaminate the soil. The air bags were used for the *Mars*  *Pathfinder* landing in 1997 and the two most recent rovers, *Spirit* and *Opportunity*, when they landed in 2004.

#### High-Tech Textiles=Advanced Materials

Because high-tech textiles require engineering skills and a knowledge of chemistry, people who work in the field often have studied several different subjects in school. Some might have majored in textile engineering. But others have studied chemical engineering, mechanical engineering, chemistry, or materials science. Courses about high-tech textiles might be called "advanced materials," because textiles have so many different applications.

"People who gravitate toward this type of work share common traits," says Fredrickson. "They have a natural curiosity about what makes things work."

So if you're detail-oriented and really want to understand the nuts and bolts of how materials come together, a career in high-tech textiles or advanced materials might be right for you.