

Researchers Develop Stronger, Lighter Tent Fabric for Military

May 2 2005

When it comes to quickly setting up temporary buildings, the U.S. military relies on structures familiar to hikers and campers – tents. These facilities, known as large-area shelters, are used for command-and-control centers, maintenance hangars and mess halls.

Researchers at North Carolina State University's College of Textiles have created a new fabric for these structures that is significantly lighter, stronger and less expensive than traditional materials. The research is sponsored by a \$360,000 grant partially funded by the U.S. Air Force.

According to Dr. Behnam Pourdeyhimi, associate dean for industry research and extension, William A. Klopman Distinguished Professor and director of the Nonwovens Cooperative Research Center, current large-area tents used by the military are made of woven polyester saturated with an impermeable rubberized coating to provide protection from fire, UV radiation and moisture. And with a weight of more than 20 ounces per square yard, they are quite heavy.

The project's goal is a fabric that offers a weight reduction of 10 to 20 percent. Pourdeyhimi and his colleagues have far exceeded that goal. "We had a fabric we had made that was quite strong, but we didn't know how far we could push it. We asked ourselves if we could take some of our existing knowledge and really push it to meet the requirements of this project," Pourdeyhimi said.

"We created a 5-ounce fabric that almost meets the strength requirements. Using two layers of that fabric we'll probably meet the

properties of the 20-ounce fabric, but with only half the weight. This can be very significant – a major breakthrough,” he said.

Pourdeyhimi says the key to the project is the composition of the nonwoven fibers. “Our fiber is a composite fiber of polyethylene, which has many tiny nylon fibers – called fibrils– within it. We like to call this fabric ‘composite islands in the sea.’ When you pull on the fabric, the stress is transferred via the weaker surrounding matrix to these tiny high-strength fibrils. These fibrils are only 1 micron, or one-millionth of a meter, across,” he said. After the fibers are created they are fused together with heat and high-pressure water jets.

Pourdeyhimi said the next step in the project is to laminate these two layers of fabric together and then have a textile partner apply an emulsion, or coating, to make the material impermeable. “We’ve made a really good fabric, now we have to make that into a really good tent fabric.

“The fabric is fairly stiff, which is fine for a tent, but when you dye it, it becomes even softer. Now we’re thinking that this could be used for other applications like outdoor fabrics such as awnings, or even apparel like hunting clothes and motorcycle jackets,” Pourdeyhimi said.

This new nonwoven material also meets or exceeds all the military’s physical property requirements for battle dress uniforms. “The military has even asked if we could create lightweight fabric ropes for soldiers. Based on the performance criteria, we think we can do that,” Pourdeyhimi said.

College of Textile researchers are now working to make this new material even lighter. “We’ll be trying out some high-performance nylon nonwoven material to see if we can achieve the same results with only a 5-ounce fabric. That would be a major breakthrough,” Pourdeyhimi said.

Pourdeyhimi said several member companies of the Nonwovens Cooperative Research Center have expressed interest in these fabrics.

“I haven’t seen fabrics like this in my 15-plus years working in nonwovens – low cost, high volume and high performance,” Pourdeyhimi said.

Source: North Carolina State University

Citation: Researchers Develop Stronger, Lighter Tent Fabric for Military (2005, May 2)
retrieved 19 April 2024 from
<https://phys.org/news/2005-05-stronger-lighter-tent-fabric-military.html>

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