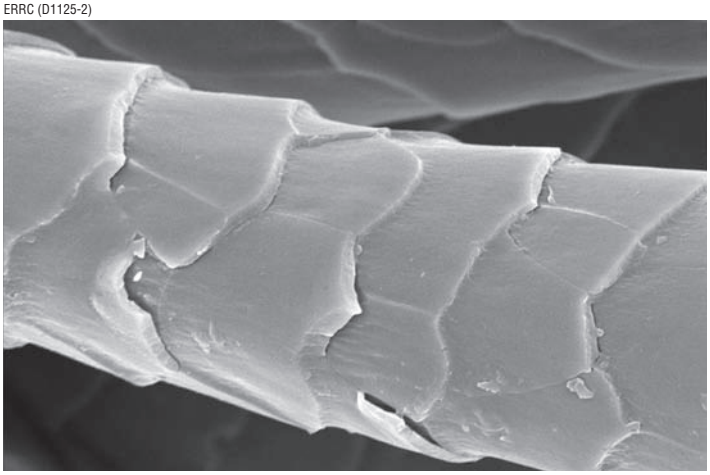
Protecting U.S. Troops With Fireproof Wool

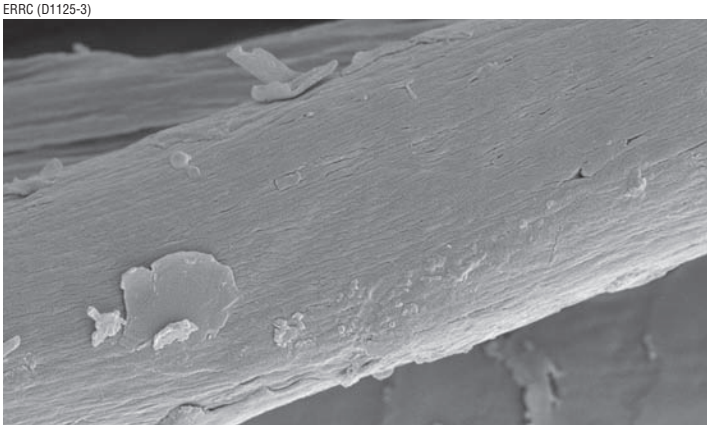
ERRC (D1125-1)

Biopolished wool, developed at the ARS Eastern Regional Research Center in Wyndmoor, Pennsylvania, is displayed as an army neck gator. A new ARS-developed polymer can be added to this fabric to make it flame retardant.

ERRC (D1125-2)



ERRC (D1125-3)



Scanning electron micrographs of untreated wool fiber (top) and wool fiber treated by the ARS biopolishing, shrinkproofing method (bottom). Magnified about 2,500x.

Though natural, untreated wool is scratchier than synthetic fabrics, wool is less susceptible to burning. This makes it an ideal fabric for uniforms worn by members of the military, firefighters, and others whose occupations expose them to fire.

"Wool burns with a self-extinguishing flame and produces a soft ash that dissipates and will not lodge in open wounds," says Jeanette M. Cardamone, a chemist at the ARS Eastern Regional Research Center (ERRC) in Wyndmoor, Pennsylvania. "Synthetic materials, on the other hand, form hot, molten beads that can drip into a wound and cause trauma."

In ERRC's Fats, Oils, and Animal Coproducts Research Unit, Cardamone has discovered and patented a heat-resistant material that can be incorporated into wool and other fabrics to match the flame resistance of commercial firefighters' uniforms. The material was developed at the request of the U.S. military—one of the largest markets for domestic wool—to offer U.S. troops protection against fire-related injuries.

In an earlier project, Cardamone developed biopolished wool that is both machine washable and itch free. Nine companies have expressed interest in licensing the patent for this technology, and the ARS Office of Technology Transfer has issued two licenses for it. This wool already has many desirable properties, so it's a natural choice for developing a fabric with improved flame retardancy.

Working with visiting scientist Anand Kanchagar, Cardamone improved the flame retardancy of the biopolished wool by treating it with a heat-resistant polymer that is stable, easy to process, and highly tolerant of extreme temperatures. Unlike some popular flame retardants, the ARS material does not use the heavy metal zirconium, which can present a health hazard during processing. While natural, synthetic, and blended fibers can be treated with the polymer, wool is particularly suitable because of its innate fire resistance.

Early tests show that the burning behavior of the polymer-treated ARS wool compares to a 50/50 blend of wool and Nomex—the fabric currently used in protective firefighting gear.

The scientists are experimenting with different methods to enhance the wool's heat-resistant and flame-retardant properties.

Cardamone says that the flame-retardant treatment should be durable to laundering.

Increasing the value and versatility of domestic wool would benefit the U.S. sheep industry, which produces about 40 million pounds of raw wool a year. In addition, U.S. consumers—including the U.S. military and many law-enforcement agencies, which are required to use domestic wool in their uniforms and equipment—would enjoy the benefits of home-grown, soft, shrinkproof, fire-retardant wool.—By **Laura McGinnis,** ARS.

This research is part of Quality and Utilization of Agricultural Products, an ARS national program (#306) described on the World Wide Web at www.nps.ars.usda.gov.

Jeanette M. Cardamone is in the USDA-ARS Fats, Oils, and Animal Coproducts Research Unit, Eastern Regional Research Center, 600 E. Mermaid Ln., Wyndmoor, PA 19038-8598; phone (215) 233-6680, fax (215) 233-6795, e-mail jan.cardamone@ars.usda.gov. ✸