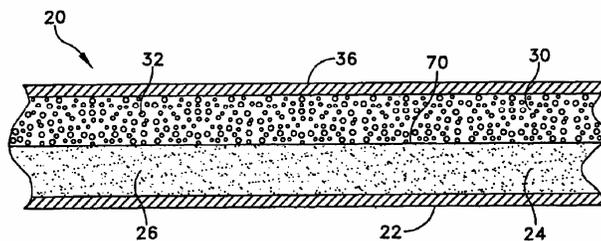


## Nanofiber Thermal Insulation

The U.S. Army Natick Research, Development, and Engineering Center patented novel insulation materials with thermal efficiency approaching that of aerogel insulation, which is the most efficient thermal insulator currently available for clothing applications. This is the first time that fibrous materials have been fabricated by electrospinning techniques for thermal insulation application. The new thermal insulation battings incorporating nanofibers would decrease the weight and bulk of current thermal protective clothing, and increase mobility for soldiers in the battlefield. The patent describes the materials and construction of multilayer thermal insulation incorporating nanofibers and mixtures of nanofibers and larger fibers:

<p>(12) <b>United States Patent</b> <b>Gibson et al.</b></p>	<p>(10) <b>Patent No.:</b> <b>US 7,494,946 B2</b> (45) <b>Date of Patent:</b> <b>Feb. 24, 2009</b></p>
<p>(54) <b>THERMAL INSULATION FOR ARTICLES OF CLOTHING</b></p>	<p>(58) <b>Field of Classification Search</b> ..... 442/341, 442/340, 376-377, 346, 228, 189, 414; 428/220 See application file for complete search history.</p>
<p>(75) Inventors: <b>Phillip W. Gibson</b>, Holliston, MA (US), <b>Calvin K. Lee</b>, Needham, MA (US)</p>	<p>(56) <b>References Cited</b> U.S. PATENT DOCUMENTS</p>
<p>(73) Assignee: <b>The United States of America as represented by the Secretary of the Army</b>, Washington, DC (US)</p>	<p>4,167,604 A 9/1979 Aldrich 4,460,645 A 7/1984 Jones et al. 4,537,822 A 8/1985 Nanri et al. 4,550,046 A 10/1985 Miller 6,077,597 A 6/2000 Pause 6,382,526 B1 5/2002 Reneker et al. 6,520,425 B1 2/2003 Reneker 2003/0041364 A1* 3/2003 Donaldson ..... 2/69</p>
<p>(* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 758 days.</p>	<p>* cited by examiner</p>
<p>(21) Appl. No.: <b>11/242,260</b></p>	<p><i>Primary Examiner</i>—Lynda Salvatore (74) <i>Attorney, Agent, or Firm</i>—Vincent J. Ranucci</p>
<p>(22) Filed: <b>Oct. 3, 2005</b></p>	<p>(57) <b>ABSTRACT</b></p>
<p>(65) <b>Prior Publication Data</b> US 2007/0077842 A1 Apr. 5, 2007</p>	<p>A thermal insulation material for articles of clothing, the material including fibers for providing thermal insulation and fibers for providing a stable structure for the material.</p>
<p>(51) <b>Int. Cl.</b> <i>D04H 1/00</i> (2006.01) <i>B32B 5/18</i> (2006.01)</p>	<p><b>36 Claims, 2 Drawing Sheets</b></p>
<p>(52) <b>U.S. Cl.</b> ..... <b>442/354; 442/341; 442/373; 442/189</b></p>	



## References/Publications

“Application of Nanofiber Technology to Nonwoven Thermal Insulation,” *Journal of Engineered Fibers and Fabrics* 2(2), pp. 32-40, 2007.

U.S. Patent 7,494,946 “Thermal Insulation for Articles of Clothing,” granted to the Natick Soldier Research Development & Engineering Center in 2009.

**Contributing Agency: DoD / RDECOM**