TIP Project Brief – 090174/10H011

Manufacturing
High-risk, Low-Cost Carbon Nanofiber Manufacturing Process Scale-Up

Develop a commercial-scale manufacturing process for producing self-supporting, non-woven fabrics of both natural and activated carbon nanofibers.

Sponsor: eSpin Technologies, Inc.
Chattanooga, TN

- Project Performance Period: 2/1/2010 - 4/2/2013
- Total project (est.): $6,006 K
- Requested TIP funds: $3,000 K

eSpin Technologies, Inc. is conducting research to scale-up a manufacturing process for producing commercial quantities of self-supporting, non-woven fabrics of both natural and activated carbon nanofibers. These fabrics have a wide range of potential applications. The current focus is on the development of low-pressure-drop, high-performance molecular air filter media. Molecular air filtration provides protection against chemical and biological weapons, toxic vapors from industrial processes and volatile organic chemicals (VOCs) emitted from new carpets and paints in offices and homes. eSpin has already innovated the manufacture of non-woven nanofiber materials with a polymer nanofiber fabric used for particulate air filters. Carbon fibers and/or activated carbon nanofibers with diameters of a few hundred to less than a hundred nanometers have very high ratios of surface-area to mass, which produces extremely lightweight and high-performance materials. Very little pressure drop occurs when non-woven mats of these nanofibers are used for air filtration thus resulting in significant energy savings. Manufacturing these innovative carbon nanofiber products on a commercial scale requires solving several major technical challenges. The fabrics are initially produced by fabricating a non-woven nanofiber web from an organic polymer. The web is then carbonized by a high-temperature thermal process. Nanofiber materials are extremely fragile and customarily are made on a substrate that provides support. However a substrate cannot be used for the thermal processing stage. Therefore a major challenge will be to produce a free-standing self-supporting nanofiber web. Additional engineering challenges include managing heat flow, removing off-gases and residual solvent, web transport and controlling the carbon structure within the nanofibers. eSpin estimates that molecular air filters—their target application—if widely utilized could save the Nation trillions of Joules of energy annually. In addition, the fundamental technology for producing free-standing non-woven carbon nanofiber materials would have a wide variety of applications in carbon-fiber composite materials because of their high strength-to-weight ratio and their relatively low cost, whereas activated carbon nanofibers are expected to have applications in energy storage devices among many other uses.

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