Electrospun Nanofiber Coating of Fiber Materials: A Composite Toughening Approach

Companies could apply this technology in producing fabric products for use in composite manufacturing.

John H. Glenn Research Center, Cleveland, Ohio

The novel feature is that fabrics do not inherently possess good thermal conductivity. In fact, fabrics are used for thermal insulation, not heat removal. The technology represents the first material that is a wearable fabric, based on company textiles and materials that will significantly conduct heat.

This work was done by L. P. Felipe Chibante of NanoTex Corporation for Johnson Space Center. Further information is contained in a TSP (see page 1). In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Refer to MSC-24389-1, volume and number of this NASA Tech Briefs issue, and the page number.

Imidazolium-Based Polymeric Materials as Alkaline Anion-Exchange Fuel Cell Membranes

Polymer electrolyte membrane fuel cells can be used for portable power sources.

NASA’s Jet Propulsion Laboratory, Pasadena, California

Polymer electrolyte membranes that conduct hydroxide ions have potential use in fuel cells. A variety of polystyrene-based quaternary ammonium hydroxides have been reported as anion exchange fuel cell membranes. However, the hydrolytic stability and conductivity of the commercially available membranes are not adequate to meet the requirements of fuel cell applications. When compared with commercially available membranes, polystyrene-imidazolium alkaline membrane electrolytes are more stable and more highly conducting. At the time of this reporting, this has been the first such usage for imidazolium-based polymeric materials for fuel cells.

Imidazolium salts are known to be electrochemically stable over wide potential ranges. By controlling the relative ratio of imidazolium groups in polystyrene-imidazolium salts, their physicochemical properties could be modulated.

Alkaline anion exchange membranes based on polystyrene-imidazolium hydroxide materials have been developed. The first step was to synthesize the poly(styrene-co-(1-((4-vinyl)methyl)-3-methylimidazolium) chloride through a free-radical polymerization. Casting of this material followed by in situ treatment of the membranes with sodium hydroxide solutions provided the corresponding hydroxide salts. Various ratios of the monomers 4-chloroethoxymethylbenzene (CMVB) and vinylbenzene (VB) provided various compositions of the polymer. The preferred material, due to the relative ease of casting the film, and its relatively low hygroscopic nature, was a 2:1 ratio of CMVB to VB.

Testing confirmed that at room temperature, the new membranes outperformed commercially available membranes by a large margin. With fuel cells now in use at NASA and in transportation, and with defense potential, any improvement to fuel cell efficiency is a significant development.

This work was done by Sri R. Narayan and Shiao-Ping S. Yen of Caltech, and Prakash V. Reddy and Nanditha Nair of Missouri University of Science and Technology for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-46457