

4 universities collaborate to synthesize new materials, nanoscale devices

April 24 2007

The Army Research Office has awarded a potentially \$7.5 million Multi-University Research Initiative (MURI) grant to scientists from Virginia Tech, the University of Pennsylvania, Pennsylvania State University, and Drexel University to develop electromechanical devices and high-performance membranes using ionic liquids.

Virginia Tech chemistry professor Tim Long and University of Pennsylvania professor of materials science and engineering Karen I. Winey are co-directors of the Ionic Liquids in Electro-Active Devices (ILEAD) MURI. Long is principal investigator.

Ionic liquids (ILs) are relatively large organic salts that offer charge and liquidity at room temperature. Some ILs are touted as safe, environmentally-friendly solvents. They are also useful in electrically conductive membranes, thermally stable at high temperatures, and do not evaporate at normal conditions. With today's advanced ability to manipulate molecular structure and design unique molecules, ILs' advantages are being explored for emerging applications. "The Army needs a myriad of electronic devices that take advantage of the potential synergy of these unique properties," Long said.

The team is creating synthetic ILs and evaluating their performance in sophisticated electronic devices. "Our challenge is to synthesize high performance materials with a particular device in mind. Then the device is truly created from the molecular-scale up," said Long.

The group will integrate ILs into membranes to create thin films to perform various functions, such as membranes that can transport or filter small molecules. "Applications include fuel cell membranes, where protons are transported across a membrane to create electricity. One advantage over existing fuel cell materials is that the IL will not evaporate, so future membranes will operate at higher temperatures with higher efficiency."

Another application could be stimuli-responsive materials for micro sensors and smart clothes, said Long. "The material would breathe and wick moisture away, but quickly close up in response to a chemical or biological threat. Such a suit could be used by the military, by a firefighter, or in an operating room."

Membranes can also be created that will bend, stretch, or change shape in response to a low voltage, like an artificial muscle.

And ILs can be used in coatings or as part of structures. The team will look at creating new polymeric materials that can be charged or conductive, Long said.

"ILs will serve as the building blocks for elastomers, fibers, and rigid plastics for such uses as protective gear and multilayer assemblies," Long said. "We are recharging a field that has been around for a couple of decades because now we are challenged with applications that require IL performance."

The MURI is charged to provide fundamental enabling science for future Army technologies.

Senior researchers will focus in three areas. Long and Virginia Tech chemistry professor Harry W. Gibson will work on synthesis of ILs and charged polymers. Winey and Penn State professor of materials science

and engineering Ralph H. Colby will do mechanical, electrical, and morphological characterization. Yossef Elabd, professor of chemical and biological engineering at Drexel University; Virginia Tech physics professor Randy Heflin; and Qiming Zhang, distinguished professor of electrical engineering at Penn State, will research performance of actuators, electro-optical devices, and membranes. Virginia Tech and Drexel are both Army Materials Centers of Excellence.

Source: Virginia Tech

Citation: 4 universities collaborate to synthesize new materials, nanoscale devices (2007, April 24) retrieved 9 April 2024 from

<https://phys.org/news/2007-04-universities-collaborate-materials-nanoscale-devices.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--