

UNC researchers study fuel cells, focus on portable possibilities

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The University of North Carolina at Chapel Hill is among the newest participants in a statewide alliance formed last summer to explore renewable and efficient energy sources. UNC is participating in the N.C. Fuel Cell Alliance through the laboratory of Dr. Joseph DeSimone, W.R. Kenan Jr. distinguished professor of chemistry and chemical engineering at UNC and N.C. State University.

DeSimone recently was elected to membership in the National Academy of Engineering.

Fuel cells directly produce power by converting chemical energy into electrical energy. UNC researchers are concerned with Proton Exchange Membrane (PEM) fuel cells; these use hydrogen or methanol as fuel. Unlike a battery that discharges, a fuel cell will continue to operate as long as it receives fuel.

Using funds from federal grants, UNC researchers have installed a fuel cell test station in the department of chemistry, a component of UNC's College of Arts and Sciences. This station is allowing researchers to test the heart of the fuel cell, the "membrane-electrode assembly," and its components.

Pending grants from the Defense Advanced Research Projects Agency (\$2.2 million) and the U.S. Department of Energy (\$2.3 million) will, if approved, complement existing support through the National Science Foundation (NSF) Science and Technology Center for Environmentally

Responsible Solvents and Processes.

These grants could provide \$5 million for operating expenses over three years.

"We think Carolina can have a big impact by making breakthroughs in basic science that can fundamentally transform the way power is harnessed from fuel cells," said DeSimone.

He directs the NSF center, a collaborative endeavor with five universities, and the new Institute for Advanced Materials, Nanoscience and Technology at UNC.

First devised in 1839, fuel cells are not currently used in the commercial industry. Researchers believe they have the potential to provide energy for a wide range of applications, such as powering laptops, providing light and heat to homes and running automobiles.

Fuel cell markets are currently valued at nearly \$1 billion and are expected to grow to more than \$13 billion in the next decade, according to projections cited by the N.C. Fuel Cell Alliance.

"You can use fuel cells anywhere you use batteries. For example, if you used a fuel cell in a laptop it could last about a week, instead of lasting three-to-four hours with batteries," said Dr. Everett Baucom, deputy director of the NSF Science and Technology Center and adjunct professor of chemistry at UNC. "Then, instead of recharging the cell you would simply replace the fuel cartridge."

UNC's fuel cell research will focus on portable uses for the technology, including laptops, cellular phones and U.S. departments of Defense and Homeland Security applications, DeSimone said.

Fuel cells offer high automotive fuel efficiency (especially in city traffic), low emissions and silent operation. Most major automotive manufacturers worldwide are active in fuel cell development, said Baucom. In addition, several ongoing demonstration projects employ fuel cells in city buses in the United States, Canada and Europe, he said.

"We are working primarily on the chemistry end, designing a new type of membrane that would give higher surface area and higher performance per unit volume," said Baucom, formerly the technology manager for DuPont's PEM division and who joined UNC in 2000. "This would lead to more effective use of the membrane."

UNC researchers are taking this field in a new direction, said DeSimone.

"Most of the PEMs used in fuel cell manufacture are solid materials. We are pioneering liquid precursors. Having a liquid precursor can open new ways of fabricating fuel cells."

UNC researchers will work with the Teflon division of DuPont in Fayetteville, the leading manufacturer of PEMs. UNC's Institute for Advanced Materials, Nanoscience and Technology and its NSF Science and Technology Center both focus on this kind of technology.

Source: The University of North Carolina

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