The Future in Two Words: Ionic Liquids

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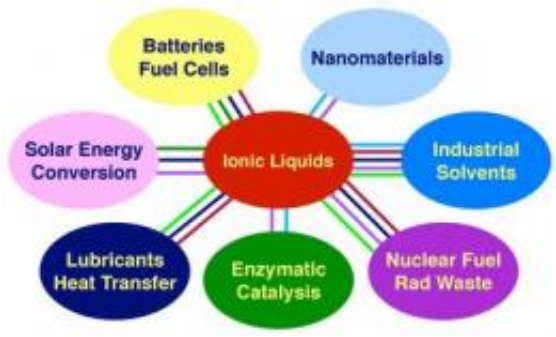

(PhysOrg.com) -- Ionic liquids are molecular solutions that have a wide range of potential applications, including next-generation solar cells, hydrogen fuel cells and lithium batteries.

As a neighbor tells a young Dustin Hoffman in The Graduate, “I just want to say one word to you - just one word: *plastics*. There’s a great future in *plastics*.” Well maybe so, but Rutgers Chemistry Professor Ed Castner thinks there is a great future in two words: *ionic liquids*.

These molecular soups can be many things to many people in many different applications, including next-generation solar cells, hydrogen fuel cells and lithium batteries. This may be what caught the eye of the U.S. Department of Energy, awarding Castner and his colleagues a grant for $2.4 million to delve into the nature of charge-transfer properties of ionic liquids. Previously, his Rutgers ionic liquids research was

supported by the American Chemical Society's Petroleum Research Fund. In addition to the new DOE funding, the Rutgers ionic liquids fundamental research is also currently funded by the National Science Foundation.

Ionic liquids by definition contain ions - atoms positively or negatively charged because they have too few or too many electrons or some other imbalance in their charge. Even with this imbalance, these ions are stable and exist freely in a solution, not bound to any other atoms as they would be in neutral (uncharged) compounds.

Successful with the DOE proposal, Castner is now the lead principal investigator on a three-year DOE-funded program. With his four co-principal investigators from Penn State, University of Iowa, University of Minnesota and Brookhaven National Laboratory, Castner and his Rutgers colleagues have assembled a top research team for investigating the properties of ionic liquids.

Batteries are a key energy technology, but they can only charge and discharge their electrical energy relatively slowly - think how a cell phone or computer battery takes hours to recharge. When the sun rises or sets on the Rutgers Solar Farm on the Livingston Campus, or when a hybrid car like a Toyota Prius uses regenerative braking technology, high performance capacitors are required.

Solar panel farm on the Rutgers Livingston Campus

New supercapacitors and ultracapacitors based on ionic liquid technology will do an even better job than the current technologies. Castner hopes to merge their basic science projects for understanding ionic liquids to help the Rutgers Energy Storage Research Group develop next-generation ultracapacitors and batteries.

Hydrogen fuel cells, a potential successor to conventional batteries, work best at temperatures well above the boiling point of water; evaporative losses can damage the device performance. Because ionic liquids almost never boil and are stable to high temperatures, fuel cells based on ionic liquids are expected to display enhanced performance.

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