Metal-Air Battery Could Store 11 Times More Energy than Lithium-Ion

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Ionic liquids (in blue) in a beaker of mineral oil. Image credit: John Wilkes.

(PhysOrg.com) -- A spinoff company from Arizona State University plans to build a new battery with an energy density 11 times greater than that of lithium-ion batteries for just one-third the cost. With a $5.13 million research grant from the US Department of Energy awarded last week, Fluidic Energy hopes to turn its ultra-dense energy storage technology into a reality.

The new Metal-Air Ionic Liquid battery is being designed by Cody Friesen, a professor of materials science at Arizona State and founder of Fluidic Energy, along with other researchers. The key to the new battery is that it uses ionic liquids as its electrolyte, which could help it

overcome some significant problems faced by previous metal-air batteries. In the past, metal-air batteries have usually used water-based electrolytes, but due to water evaporation, the batteries tended to fail prematurely.

The advantage of ionic liquids, like those used in Fluidic Energy's new battery, is that they don't evaporate. Ionic liquids are salts that are a liquid at room temperature. Compared to water, ionic liquids are much more viscous, and they also conduct electricity fairly well. The challenge will be finding an inexpensive ionic liquid that works well in the new batteries, although Friesen has not yet discussed the specific ionic liquids his company has been investigating.

A metal-air battery that uses ionic liquids as its electrolyte could have several advantages. For one thing, it can function for a longer period time since its electrolyte doesn't evaporate. Also, the batteries could offer better electrochemical stability, which means they could use materials that have a greater energy density than zinc. Friesen and his research team hope to achieve energy densities of anywhere from 900 to 1,600 watt-hours per kilogram. This density could lead to electric vehicles that could travel 400 to 500 miles on a single charge, Friesen said.

Finally, Fluidic Energy is tackling another problem facing rechargeable batteries: the growth of dendrites that occurs on the electrodes during charging. Dendrites limit the number of charging cycles and decrease the lifetime of the battery. To combat this problem, Fluidic Energy has designed a porous electrode scaffold that prevents dendrite formation.

"I'm not claiming we have it yet, but if we do succeed, it really does change the way we think about storage," Friesen said.

via: Technology Review