

New high-energy cathode material can significantly increase safety, life of lithium batteries

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(PhysOrg.com) -- A new high-energy cathode material that can greatly increase the safety and extend the life-span of future lithium batteries has been developed through the close international collaboration of researchers led by the U.S. Department of Energy's Argonne National Laboratory and Hanyang University in South Korea.

Developing a very high-energy system with a long calendar and cycle life and excellent abuse tolerance is an important challenge that lithium battery developers are working on to meet the energy storage needs of the light-duty vehicle market and to help achieve President Barack Obama's goal of putting more than one-million plug-in hybrid electric vehicles (PHEV) on the road by 2015.

"The new high-energy material that we developed makes up a new class of oxide materials in which the composition of each particle is changing from the bulk to the outer layer," said Khalil Amine, manager of the advanced battery technology group at Argonne and the project's co-principal investigator. "Typically most oxide cathodes have a uniform composition throughout each particle, and offer low capacity and high surface reactivity with the electrolyte."

The transitional nature of this new class of oxide material's composition gives it greater functionality. "The basic idea behind our novel approach," Amine said, "is to design a particle that has a very high-

energy composition at the bulk and an outer layer composition that is very stable against any reactivity with electrolyte. Those two design features will be able to improve significantly the life and safety of lithium battery materials while offering very high-energy characteristics for possible use in PHEVs."

The material has also demonstrated a very high-power capability, said Yank-Kook Sun, co-principle investigator and a professor in the Department of Chemical Engineering at Hanyang University. "We are able to charge the material to 4.3 and 4.4 volts and attain a very high capacity of more than 210 milliampere hours per gram, with good power capability," he said. "Conventional cathodes have a capacity of 140 to 160 mAh/g."

The research is described in the paper "High-energy cathode materials for long-life and safe lithium batteries," and is available on the Nature Materials website.

More information: www.nature.com/nmat/index.html

Provided by Argonne National Laboratory

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