EPP and Center for Climate and Energy Decision Making and Vehicle Electrification Group

Sponsored Seminar

Kevin Gallagher
Principle Investigator for Systems Analysis and Translation in the Joint Center for Energy Storage Research

Presenting on:

"Quantifying the Promise of Li-Air Batteries for Electric Vehicles"

November 25, 2013
12:30 PM
(Lunch served at 12:15 pm)
129 Baker Conference Room
Department of Engineering and Public Policy

Seminar Abstract: The commercialization of battery electric vehicles has provided a glimpse of one potential future paradigm of the transportation sector. Moving to an electron-based transportation system could enable a domestically produced, potentially near-zero emission transportation energy source if coupled to clean, domestic sources of electricity. However, the batteries used in electric vehicles in 2013 are too expensive, large, and heavy for mass market adoption; significant progress is needed. The lithium-air or lithium-oxygen battery is a high visibility archetype for the "best-case" possible electrochemical energy-storage system for electric vehicles. We present a material-to-systems analysis of the lithium-oxygen chemistry within the context of current and other future lithium-based chemistries to identify scientific challenges and technological possibilities. Through translation of materials-level science to the systems-level engineering, we show that a lithium-oxygen battery that meets automotive specifications has comparable cost, volume, and mass to other advanced chemistries that are in more mature states of development. Existing Li-ion battery technology will continue to improve; however, the successful development of advanced chemistries will be necessary for batteries to reach long-term automotive goals. This analysis demonstrates that system-level analysis is necessary and may contradict trends predicted from theoretical thermodynamic specific energy and energy density calculations that are the basis for many research investment decisions.

Speaker Bio: Kevin Gallagher is the Principle Investigator for Systems Analysis and Translation in the Joint Center for Energy Storage Research (the DOE-BES Battery and Energy Storage Innovation Hub) and an electrochemical engineer in the Chemical Science and Engineering Division at Argonne National Laboratory. His work has focused on techno-economic and continuum-scale modeling, electrochemical characterization, and materials development in advanced and beyond lithium-ion systems. He is a co-creator of the freely available bottom-up Battery Performance and Cost model (BatPaC) that has been used to support the 2017-2025 GHG and CAFE regulations for light duty vehicles. He received his PhD in Chemical & Biomolecular Engineering from the Georgia Institute of Technology in 2009 and his BS in Chemical Engineering from the University of Michigan in 2003. In-between undergraduate and graduate school, Kevin was a process engineer at a leading consumer products company.

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