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Designing High-Energy Lithium-ion Cells

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ABSTRACT:

Rechargeable Li-ion cells present the highest energy and power density of any commercial battery technology. These cells constitute the main power source of modern consumer electronics, and are being increasingly considered for space satellites, medical devices, and distributed energy storage applications. In addition, considerable materials research is being conducted at Argonne to extend Li-ion battery technology to hybrid electric vehicles (HEVs), plug-in HEVs, and battery electric vehicles (EVs), wherein the challenge is to achieve extended driving range (i.e., high energy), high charge/discharge rates (i.e., high power), and long calendar life (i.e., high stability) in a safe and cost-efficient manner. Various lithium-ion battery chemistries, including negative electrodes with various graphite morphologies, positive electrodes containing layered– and spinel–oxides, and electrolytes containing various salts and additives are being examined at Argonne. This presentation will highlight electrode combinations that yield high energy densities and power densities, with a focus on cathode materials, and identify phenomena responsible for cell performance and performance degradation. Strategies to design safe, long-life, lithium-ion batteries will also be described.

BIOGRAPHY:

Daniel Abraham received his Ph.D.in metallurgical engineering from university of Illinois at Urbana-Champaign in 1993. He leads the effort at Argonne to identify performance degradation mechanisms in lithium ion cells. He is responsible for the development of advanced diagnostic tools and techniques that include diffraction, microscopy, spectroscopy and electrochemistry methodologies. His work enables the development of battery materials and components that enhance cell performance, life, and safety. Daniel received his Ph.D. in 1993 from the University of Illinois at Urbana-Champaign.