

Materials challenges and prospects of electrical energy storage

Arumugam Manthiram

University of Texas at Austin, USA

Abstract

Electrical energy stored in batteries, particularly lithium-ion batteries, powers most of the modern portable electronic devices such as cellphones and laptops. Batteries are also being pursued intensively for electric vehicles and stationary storage of electricity produced by renewable sources like solar and wind. However, their adoption for transportation and stationary storage applications requires significant reduction in cost, long cycle life, increase in energy and power, and improvement in safety, which are in turn controlled by the component materials used in batteries. Clearly, development of new materials for existing battery technologies or new battery chemistries at an affordable cost with long life is needed to address our future energy needs. Accordingly, this presentation will focus on the development of next generation of electrode materials for lithium-ion batteries as well as new battery chemistries such as sodium-ion batteries and dual-electrolyte lithium-air batteries.

Specifically, high-capacity, high-voltage oxide and high-capacity sulfur cathodes as well as safe nano-engineered alloy anodes for lithium-ion batteries will be first presented, emphasizing the importance of optimizing the surface and bulk structures and novel cell configurations to overcome the persistent problems in the field. Sodium is more abundant than lithium, so development of electrode materials for sodium-ion batteries will then be presented. Finally, buffer catholyte solutions with optimum pH and inexpensive catalysts for dual-electrolyte lithium-air or sodium-air cells in which the lithium or sodium anode in an organic electrolyte is separated by a solid electrolyte from the air electrode in an aqueous catholyte solution will be presented.

Biography

Arumugam Manthiram obtained his Ph.D in 1980 from the Indian Institute of Technology at Chennai and postdoctoral training at the University of Oxford and at the University of Texas at Austin (UT-Austin). He is currently the Joe C. Walter Chair in Engineering and Director of the Texas Materials Institute at UT-Austin. His research is focused on materials for clean energy technologies. He has published more than 400 papers in reputed journals. He is the Regional (USA) Editor of *Solid State Ionics* and is serving as an editorial board member for 5 other journals.