Recent Developments in Zinc-Based Batteries

Timothy N. Lambert

Department of Photovoltaics and Materials Technology and The Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, NM, USA 87185

*tnlambe@sandia.gov

For energy storage to become ubiquitous in the grid, safe, reliable low-cost electrochemical storage technologies that can be manufactured at high volumes with low capital expenditures are needed. Rechargeable batteries based on the use of a zinc (Zn) conversion anode are well suited for grid and long duration energy storage applications. Metallic Zn is a nearly ideal anode owing to its low cost (*ca.* 2 USD kg^{-1}), existing supply chain, high stability in water [−0.76 V *vs* standard hydrogen electrode (SHE)], high theoretical capacity ($2e^-$ @ 820 mAh g^{-1} and 5855 mA h cm^{-3}) and overall low polarizability (6×10^{-8} Ω m). Aqueous Zn-based cells are also environmentally benign, inherently safe and do not have the temperature limitations of Li-ion or Pb-acid batteries, thereby removing the need for complicated thermal management control strategies, and providing for simpler systems with lower integration costs. These attributes further motivate Zn-based batteries as alternatives to lead acid and lithium-ion batteries, despite their considerably lower operating voltages (< 2V). Despite many recent advances, the high-capacity utilization of Zn for thousands of cycles remains a challenge, with cycle life typically obtained at the expense of energy density. This talk will cover recent developments and materials strategies towards cycling zinc at high areal and volumetric capacities, properties that are requisite to take studies from the laboratory and adapt them to a commercial battery technology to support grid and long duration energy storage needs.

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