Title: Safety Evaluation of Next-generation Solid-State Li-ion Battery

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Abstract

The state-of-the-art Li-ion battery (LIB) has desired attributes such as high energy density, high power density, and good cycle life for many applications. However, it suffers from a significant safety issue wherein the battery can fail when subjected to over-charge, over-discharge, or an internal/external short circuit, all of which lead to thermal runaway resulting in catastrophic electrolyte (flammable) venting with flame. The near-term solution is to use a fireproof battery enclosure (made of heavy/thick stainless steel) to contain the battery fire, which is costly and dramatically reduces the battery's energy density. The best and long-term solution is to make the active components of a battery inherently thermally stable, either fireproof or a level of stability that inhibits thermal runaway in the next generation LIB.

The University of Dayton Research Institute (UDRI) is developing all-solid-state lithium batteries (ASLB) with enhanced thermal safety. To achieve a high-level battery in a next generation LIB, UDRI is replacing the flammable liquid electrolyte with an inorganic solid-state electrolyte with better electrical (electrical short circuit prevention) and thermal stabilities. The safety of ASLB is being evaluated under a Federal Aviation Administration (FAA) funded project. The presentation will focus on i) safety issues related to the commercial LIB and ii) electrical and thermal safety characteristics of ASLB at the component and cell level. Important data and analysis that underlines a better battery fire with ASLB than commercial LIB will be presented.