Ninth Triennial Conference / FAA Fire Safety (10/28/2019 – 10/31/2019)

Presentation Title: Solid-State Li-ion Battery for High-Safety and Longevity

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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 acceptable cycle life for many applications, however, it suffers from a major safety issue wherein the battery can fail violently 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 fire proof battery enclosure (made of heavy/thick stainless steel) to contain the battery fire, which is costly and greatly reduces energy density of battery. The best and long-term solution is to make the active components of a battery inherently thermally stable, either fire proof or a level of stability that inhibits thermal runway in a battery.

To achieve safety (non-flammability), without use of any fire proof enclosure and with aid of minimum thermal management system, required for high energy batteries, the University of Dayton Research Institute (UDRI) has been developing solid-state ceramic electrolytes and related batteries. Presentation will relates to the current research and developments on how solid-state electrolytes especially inorganic ceramic electrolytes can mitigate safety issues related to i) the state of the art LIB (using non-flammable liquid electrolyte) and ii) the next generation all solid state safe LIB. To make SOA LIB inherently stable, thermally stable battery cell materials (ceramic electrolyte coated separator and cathode) are being developed (under current Federal Aviation Administration (FAA) funded project). To achieve complete safety in a high energy/power lithium battery, the LIB cell with all solid-state components (anode, cathode and electrolyte) are being developed under National Aeronautics and Space Administration (NASA), US Army, US Department of Energy. Important data that relates to safety of a battery will be presented.