HAZARDOUS MATERIALS

Lithium Batteries
Fuel Cells

Federal Aviation Administration

Presented to: Systems Working Group

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Lithium-Ion Battery Report

- **Final report published**
- **“Flammability Assessment of Bulk Packed, Rechargeable Lithium-Ion Cells in Transport Category Aircraft”, Harry Webster DOT/FAA/AR-06/38, September 2006**
- **Available on our website**
- **www.fire.tc.faa.gov**

Rule Making-Lithium Cells

- **FAA and PHMSA are working with the ICAO Dangerous Goods Panel on new rules for international transport of batteries including specific rules involving transport of Lithium cells**
- **Discussion items include:**
  - Banning shipment of lithium primary cells on cargo aircraft (already banned on passenger aircraft)
  - Elimination of special conditions provision allowing shipment of certain lithium cells as undeclared cargo, requiring relabeling as class 9 Hazardous Material

Rule Making-Lithium Cells

- **Discussion items (continued)**
  - Amendment of the ICAO hazmat response procedures to give crews more specific instruction in fighting a lithium battery fire

Future Tests- Lithium Cells

- **Evaluation fire hazards of Lithium Cells installed on aircraft as part of airframe systems**
  - Assess the safety impact of presence of Lithium cells on aircraft, including an evaluation of the various chemistries, and potential threat from explosion, fragments, gases released and toxicity
  - Evaluate Lithium Cells that have already been approved for use, including charging and monitoring systems, when exposed to expected environmental extremes on board the aircraft

Future Tests- Lithium Cells

- Evaluate threat of worst case state of charge conditions when exposed to expected extremes in the aircraft operating evironment
- Perform tests on representative avionics units that have lithium cells installed including associated battery/ cell monitoring and charging systems when exposed to extremes of the aircraft operating environment

FUEL CELLS

- **Definition: An electrochemical cell in which the energy of a reaction between a fuel, such as liquid hydrogen, and an oxidant, such as liquid oxygen, is converted directly and continuously into electrical energy**
- **FAA Concerns**
  - In-flight use and operation
  - Carry on luggage
  - Checked luggage
  - Bulk Shipment

Micro Fuel Cell Fuels

- **Methanol**
  - Methanol is oxidized directly in the Direct Methanol Fuel Cell (DMFC) system.
  - Reformed methanol fuel cells (RMFC) produce hydrogen “on demand” and consume the hydrogen immediately within the fuel cell.

- **Formic Acid**
  - Fuel (formic acid) concentration: < 85% wt (Not Flammable).
  - Formic acid is oxidized directly in the Formic Acid Fuel.

Micro Fuel Cell Fuels

- **Borohydride**
  - Direct liquid Borohydride (Class 8) is oxidized directly in the Direct Borohydride Fuel Cell (DBFC) system.
  - Indirect Borohydride (Class 8 or 4.3) produce hydrogen “on demand” and consume the hydrogen immediately within the fuel cell.
- **Butane**
  - A Butane or a Butane/Propane mix is oxidized directly by a solid oxide fuel cell system.
- **Hydrogen Stored in Metal Hydrides**
  - Hydrogen gas is chemically stored in metal powder under low pressure.
  - Hydrogen is produced “on demand” and consumed immediately within the fuel cell.

Micro Fuel Cell Powered Small Gadgets

music player

cell phone

handy terminal

fuel cartridge

Micro fuel cell powered Laptops

fuel cell cartridge installation

Examples


SFC


SFC
Smart Fuel Cell
M125
Methanol
SFC
Smart Fuel Cell
M125
Methanol


jadoo
jadoo
FILL ONE

Examples

Examples

Future Fuel Cell Tests

- **FAA Fire Safety engineers are currently supporting FAA HAZMAT and PHMSA in developing rule makings regarding fuel cell use in flight, packed in checked and carry on luggage, and bulk shipping.**
- **Flammability tests will be conducted on the different technologies as production units become available:**
  - Individual units
  - Bulk shipments
  - Fuel cells in use powering electronic equipment
  - Fuel cells charging batteries