Lithium Batteries

Safe Handling and Proper PPE & General Information

I’m not endorsing or recommending any product or manufacturer shown in these slides. For educational purposes only.
Lithium Battery Action Plan

• If you facility uses or stores Li-ion batteries you should have a written Li-ion Action Plan

• This awareness training module is not a substitute for dealing with Li-ion emergencies or Li-ion extinguishment training
Lithium Battery Storage

• The International Fire Code covers storage requirements for systems having an electrolyte capacity of 454kg or 1000 pounds for Li-ion or LiPO (lithium polymer) batteries used for standby power, emergency power or uninterrupted power supplies

• Check your local ordinances or state fire code for more information
Lithium Batteries Uses
Lithium Batteries Uses
Electric Car Battery Assembly
Lithium Batteries
A lithium-polymer (LiPo, LIP or Li-Poly) battery is a type of rechargeable battery that uses a soft polymer casing so that the lithium-ion battery inside it rests in a soft external “pouch.” It may also refer to a lithium-ion battery that uses a gelled polymer as an electrolyte. However, the term commonly refers to a type of lithium-ion battery in a pouch format.
A battery room inside a data center campus in Richmond, Va. These batteries provide temporary emergency power for UPS systems.
Lithium Batteries
Lithium Battery Explosion Arizona 4/19/2019
Lithium Battery Advantages

• high energy and high load capacities

• long cycle and extended shelf life

• maintenance free

• high capacity, low internal resistance, good coulombic efficiency

• simple charge algorithm and reasonable short charge times

• Low discharge rate, less than half of NiCd or NiMH batteries

Coulombic efficiency (CE), also called faradaic efficiency or current efficiency, describes the charge efficiency by which electrons are transferred in batteries. CE is the ratio of the total charge extracted from the battery to the total charge put into the battery over a full cycle.
Lithium Batteries Disadvantages

- circuit protection requirement to prevent thermal run-away if stressed
- degradation at high temperatures and when stored at high voltage
- no rapid charge possible at freezing temperatures <0 degrees F
- severe transportation regulations required when shipping in large quantities
- comprised batteries require special shipping containers
- lithium and water do not mix
Lithium Battery Chemical Hazards

Although Li-ion batteries are designed not to release gases or chemical content during normal conditions, accidental exposure for casing rupture due to mechanical damage, internal pressure or other faults can happen resulting in:

- Chemical spillage
- Exposure to toxic, corrosive and or flammable solutions or gases.
- Hydrogen gas is flammable and explosive in an enclosure
- Hydrofluoric acid fumes escaping from a battery is toxic
- If one was to put a burning battery in a bucket of water the H gas and HF are not water soluble and will rise from the water and still pose an inhalation hazard
<table>
<thead>
<tr>
<th>Gas</th>
<th>Concentration (%)</th>
<th>Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>~30</td>
<td>Asphyxiant</td>
</tr>
<tr>
<td>Hydrogen (H₂)</td>
<td>~30</td>
<td>Flammable</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>~20-25</td>
<td>Flammable, Toxic</td>
</tr>
<tr>
<td>Methane</td>
<td>5-8</td>
<td>Flammable</td>
</tr>
<tr>
<td>Ethylene</td>
<td>3-8</td>
<td>Flammable</td>
</tr>
<tr>
<td>Ethane</td>
<td>1-3</td>
<td>Flammable</td>
</tr>
<tr>
<td>Propylene</td>
<td>1-3</td>
<td>Flammable</td>
</tr>
<tr>
<td>C4s and others</td>
<td>&lt;1</td>
<td>Flammable</td>
</tr>
<tr>
<td>HF</td>
<td>0.3</td>
<td>Corrosive, Toxic</td>
</tr>
</tbody>
</table>
Lithium Batteries Electrical Hazards

The state of charge needs to be controlled. Most Li-ion cells have a low individual charge.

In larger serial assemblies voltages are much higher

Disconnect or turn off the device before charging

Charge at moderate temperature, above freezing and not near a heat source like a radiator, heating device, kitchen stove.

Disconnect the charger if the unit gets excessively hot

Not all chargers apply a full charge and the battery light will show green. (Chevy Volt)
Lithium Battery Thermal Run-Away Hazards

- Use of cells in a high temperature environment

- Internal defect causing a short circuit causing a localized “hot spot”

- Surge in charging or discharging. Heat always occurs, higher the current the more heat. Improper connections at battery tabs causing resistance

- Mechanic damage cause internal shorts:
  - Improper shipping
  - Hitting curbs
  - Impacts
  - Misuse
  - Improper disposal, crushing or puncturing
Lithium Battery Thermal Run-Away Hazards

• during thermal run-away Li-ion cells can explode and eject their contents

• flammable gases produced during thermal run-away ignited in confined environments can present an explosion hazard

• larger battery pacs will cause larger explosions due to more flammable gases being produced

• In the event of a Li-ion battery explosion battery debris will be projected and the room will quickly fill with dense white smoke that can cause irritation to the respiratory tract, eyes and skin. Ventilation must be initiated until the smoke is totally evacuated and the odor is gone.
Lithium Battery Thermal Run-Away Hazards

When a battery module overheats, catches fire and explodes, batteries will be ejected. It is paramount that all missing batteries are accounted for. Each ejected battery is a potential source for a second or tertiary fire.
Burning Li-ion Batteries
You REUSE
Cell Block Aggregate

- CellBlock FCS (Fire Containment Systems) were developed for the safe storage, collection, containment and transportation of lithium-ion batteries and products.

- CellBlock FCS employs panels and tiles made from expanded glass aggregate bound with multiple pozzolans. They are finished with a cementitious powder coating that features expanded glass and basalt fibers. The resulting product is a strong, lightweight fire containment panel that can withstand temperatures in excess of 1100°C (2012°F) for extended periods of time with negligible heat transfer.

- Pozzolans are a broad class of siliceous and aluminous materials which, in themselves, possess little or no cementitious value but which will, in finely divided form and in the presence of water, react chemically with calcium hydroxide at ordinary temperature to form compounds possessing cementitious properties.
BiPower Li-ion Battery SDS

(Material) Safety Data Sheet (SDS / MSDS) OSHA - HCS 29 CFR 1910.1200

The information contained within is provided as a service to our customers and for their information only. The information and recommendations set forth herein are made in good faith and are believed to be accurate as of the date of preparation or revision. BiPOWER makes no warranty expressed or implied, and disclaims all liabilities from reliance on it.

Section 1 – Identification

1.1 Product Name and Description:
Battery: Lithium-ion, Rechargeable, Non-venting cells and batteries.
Electro-chemistry: Lithium-ion (Li-ion)

This Safety Data Sheet covers all lithium ion rechargeable cells and batteries supplied by BIPOWER CORP.

1.2 Supplier

Office Address
BIPOWER CORP,
2560 Corporate Place, Suite D203
Monterey Park, CA 91754
USA

Telephone Numbers For Information
Telephone: (323) 981-9498
Fax: (323) 981-9468
Emergency Telephone: (323) 981-9498
Date of Revision: January-11-2017

Section 2 – Hazard(s) Identification

The lithium ion cell/battery covered in this Data Sheet is hermetically sealed in an aluminum alloy or metal case and not hazardous if used as recommended by the manufacturer.

Under a normal condition of use, the electrode materials and electrolyte contained in a cell/battery are non-reactive provided the battery integrity is maintained. Risk of exposure exists only in case of mechanical, electrical or thermal abuse.

Warning: the cells/batteries should not be short circuited, punctured, incinerated, crushed,
Lithium Ion Battery Disposal

Improperly disposed batteries contribute to water and air pollution. When depleted batteries are tossed into the trash, they end up in landfills where they decay and leak. As batteries corrode, their chemicals soak into soil and contaminate groundwater and surface water.

COVINGTON, Ga. (January 5, 2022) — Battery Resourcers, a vertically integrated lithium-ion battery recycling and engineered materials company, today announced plans to open a commercial-scale, lithium-ion battery recycling facility in Covington, Ga. When the 154,000-square-foot facility is fully operational in August 2022, it will be North America’s largest battery recycling facility with capacity to process 30,000 metric tons of discarded lithium-ion batteries and scrap per year.
Learn About Batteries

Basics You Should Know
Addresses the mechanics of the battery and deals

The Battery and You
Looks at battery personalities and discusses ways

Batteries as Power Source
Studies the battery in portable and stationary
Would you enter an elevator with someone who has a device that has a potentially larger than normal lithium-ion battery???
QUESTIONS?
COMMENTS?
CONCERNS?