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NATIONAL RENEWABLE ENERGY LABORATORY

Safety Hazards of Batteries

Battery technology is at the heart of much of our technological revolution. One of the most prevalent rechargeable batteries in use today is the Lithium-ion battery. Cell phones, laptop computers, GPS systems, iPods, and even cars are now using lithium-ion rechargeable battery technology. In fact, you probably have a lithium-ion battery in your pocket or purse right now!

Although lithium-ion batteries are very common there are some inherent dangers when using **ANY** battery. Lithium cells are like any other technology – if they are abused and not used for their intended purpose catastrophic results may occur, such as: first-, second-, and third-degree burns, respiratory problems, fires, explosions, and even death. Please handle the lithium-ion batteries with care and respect.

User Safety Precautions

Short-Circuiting

- **When the battery is not in use, you MUST disconnect the battery from the battery connector. When the battery is connected to the battery connector, do not leave unattended since the two wires with the alligator clips can touch which will heat up the battery. Short circuiting will damage the battery and generate heat that can cause burns.**
- Don't leave the battery in the charger once it is fully charged. The battery charger will flash on and off with a red indicator light every 20 seconds when the battery is fully charged. Overcharging the batteries will not increase the performance and could lead to damage.

Disassembly

- Never disassemble a battery as the materials inside may be toxic and may damage skin and clothes.
- DO NOT place a battery in fire; this may cause the battery to rupture. The electrolyte is very flammable and if an ignition source exists, then fire and even an explosion could result.
- NEVER place batteries in water, as this may cause the battery to rupture and release poisonous gasses. Furthermore, when the electrolyte is combined with water, there is the potential for hydrofluoric acid to form – an extremely toxic and

corrosive substance. To learn more about hydrofluoric acid, visit the following link to the Centers for Disease Control's website: http://www.bt.cdc.gov/agent/hydrofluoricacid/basics/facts.asp

Soldering

- Never solder anything directly to a battery. This can destroy the safety features of the battery by damaging the safety vent inside the cap.

Charging

- Never charge with an unspecified charger or specified charger that has been modified. This can cause breakdown of the battery or swelling and rupturing.
- Never attempt to charge a battery which has been physically damaged.
- Avoid designing airtight battery compartments. In some cases, gases (oxygen, hydrogen) may be given off, and there is a danger of a battery bursting or rupturing if ignited by sparks.
- Do not use a battery in an appliance or purpose for which it was not intended.

Safety Procedures

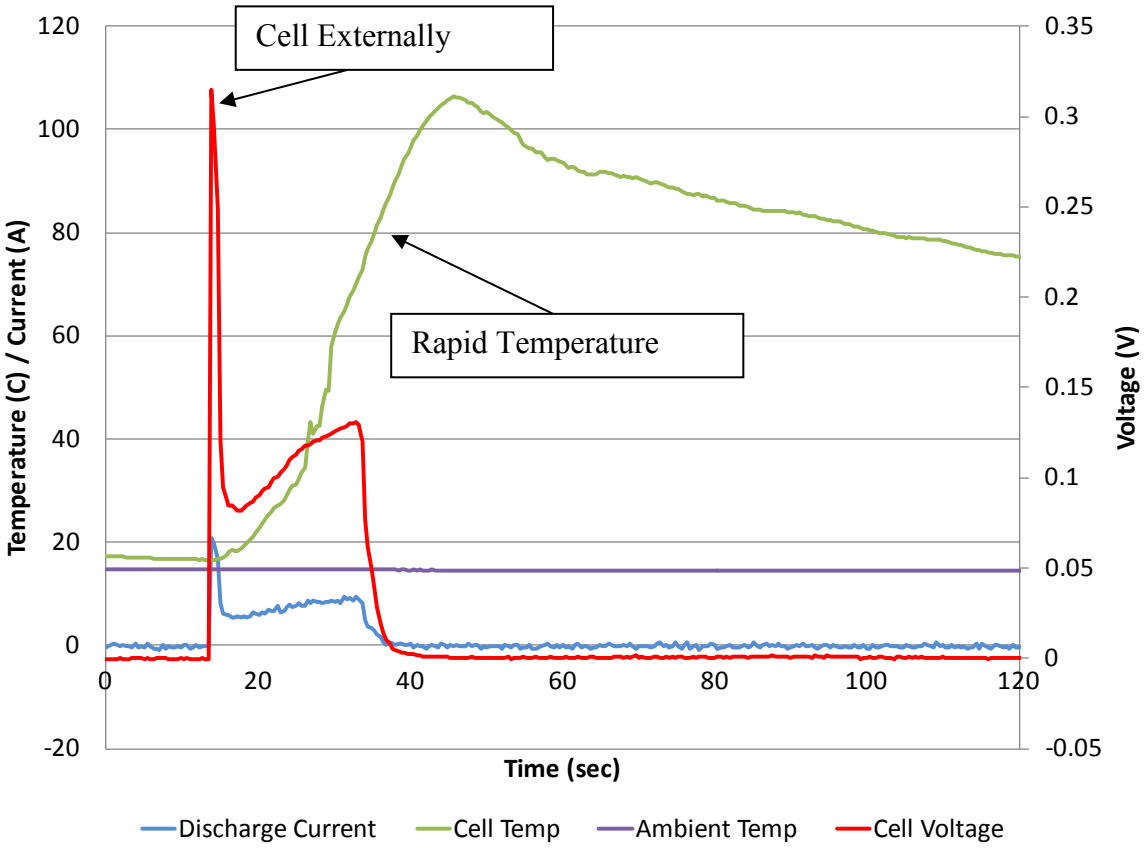
- If the foil packaging on the battery does break, vent the room and leave area.
- If a fire starts, call the fire department immediately. The only extinguisher that will work on a Lithium-ion Battery fire is a Class D Fire Extinguisher or Dry Sand or Dry Table Salt.

Battery Disposal

Lithium-ion batteries are found in many electronics like laptops, digital cameras, power tools, and cordless phones. These batteries are very popular because they can be recharged and because they are able to supply power for a long period of time. However, even lithium-ion batteries reach a point where they can no longer hold a charge and need to be disposed of. When this time comes, it is important to know how to recycle the battery, and not simply put it in a trash can. Determine your states recycling policy.

There are many reasons to recycle these batteries rather than throw them away where they may end up in a regular landfill. This is because they enter the solid waste stream and can contaminate soil and water. Please check with your school on their policy of recycling of batteries.

Externally Short Circuit Cell



- After the cell was externally shorted (akin to dropping a wrench across the positive and negative terminals), the temperature of the cell rose to approximately 106°C (223°F).
- The excessive temperatures within the cell caused the electrolyte to internally vaporize; this, in turn, pressurized the aluminum packaging material of the battery.
- After pressurization, the aluminum packaging vented out of the bottom of the cell and liquid electrolyte was seen on the test surface.
- Smoke also exited the vent hole but a fire did not result.
- The current draw from the battery exceeded the 12C rating of the cell by a factor of 10.