Lithium-Ion Batteries from Electronics

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Lithium Metal Batteries

Two types:
- Non-rechargeable, primary batteries; use lithium metal in AA or 9V format.
- Rechargeable lithium-polymer cells; uses a lithium electrolyte that passes through a porous membrane, creating voltage.

Compared to other batteries:
- High charge density (more energy)
- Lighter weights
- Charge lasts longer
- Potentially higher voltages (3 V vs. 1.5 V for alkaline batteries)

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Li-Ion Batteries in Electronic Devices

- Found in cell phones, tablets, computers, e-cigarettes, power tools, large and small appliances, electronic cars and golf carts, etc.
- Demand rising - smaller, portable devices and “smartening” of items.
- May look like ‘AA”, ‘AAA’ or button.
- Packed in a flexible plastic pouch.

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Volumes are Expected to Increase

**Waste Not**

The volume of lithium ion battery cells being sold is set to surge, creating opportunities for recyclers

- Electronics
- Power tools
- Electric cars
- E-buses, bikes and scooters
- Energy storage
- Industrial automation
- Data centers
- Telecom
- Other

Worldwide: 5.5-6 B li-ion cells are manufactured annually.

Source: Creation Inn

Bloomberg
Li-ion Battery Chemistries

- Batteries are made using different mixtures of chemical elements to meet power and performance needs. For example:
  - Longer battery life
  - Number of charges
  - Use during extreme temperatures.

- Li-ion batteries may contain cobalt, lithium, manganese, nickel and graphite.
  - Co, Li and Gr are critical in supply
  - Need maximum recovery

- Chart: Where material is sourced

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Barriers to Material Recovery

• Consumer knowledge about:
  • Products that use Li-ion batteries
  • Proper recycling of electronics and batteries
  • Confusing labels for Li-ion batteries
• Product design around batteries:
  • Some are easily removed (e.g., hand tools)
  • Some are imbedded or glued and difficult to remove (e.g., tablets, phones)
• Material recovery capability, capacity and markets
  • Co, Li, and Gr
  • Secondary markets
• Thermal events at:
  • Electronics recyclers,
  • MRFs, and
  • Transport

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Electronics Recyclers
• Removing imbedded batteries can damage batteries
  • Cause a fire hazard
  • Fire may occur on recycling line or in storage
• If not removed, batteries may explode during shredding

Material Recovery Facilities:
• Electronics or batteries put in recycling bins
  • Sorting machine or heavy equipment may crush or break the battery, causing a short
  • Fuel (oxygen, paper, dust) may feed the fire

Other facilities:
• C&D, scrap metal, paper and plastic recycling facilities and landfills are all experiencing these fires

Over ½ the fires attributed to batteries; rest from traditional sources (e.g., aerosols, chemicals).
What Can We Do?

- Educate consumers:
  - What products have Li batteries
  - How to recycle batteries/electronics properly
- Work with the manufacturers to design products to have easily removeable batteries.
- Encourage collectors/ shippers to get trained in Call2Recycle’s Charge up Safety Campaign.
- Investigate if your local landfills, MRFs and recycling programs are experiencing li-ion caused fires.
- Connect with industry in your area to see what they can do to help.

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Li-ion Battery: Efforts by the Federal Government

US Environmental Protection Agency:
• Webinars: SMM web academy and Solving the Ewaste Problem
• Domestic and international presentations, panels and general engagement with industry
• New webpages: general batteries and li-ion batteries

US Department of Transportation:
• DOT/ EPA are working together to train electronics and battery recyclers on proper packaging, labeling and transportation.
• R-5: 8/14; R-9: 9/5; E-Scrap 9/23, E-Reuse 11/11

US Department of Energy:
• Li-ion Battery Prize
• Research and development and verification of new battery formulations