
CHARGED FOR SAFETY:
LITHIUM BATTERIES IN CONSTRUCTION
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Owner: J.A.S Training & Safety Solutions LLC
LITHIUM
BATTERY

Class Expectations:

- Cell Phones and Mobile Devices
- Participation
- Course Evaluations

Class Introductions:

- Your Name
- Your Company / Job
- Your Experience
- Your Expectations for the Class

Learning Objectives:

- Identify lithium-ion battery hazards
- Recognize conditions leading to thermal runaway
- Apply best practices for use, charging, and storage
- Understand appropriate fire extinguishment and emergency response

Disclaimer:

- Nothing herein is to be regarded as indicating approval or disapproval of any action that may violate any Federal, State or City codes, rules, regulations, or standards.
- The training is not intended to replace other company policies nor the relevant OSHA, ANSI, Federal, State, City, or other codes, rules, regulations, or standards. Consult the specific code, rule, regulation, or standard, for more detailed information and your supervisor for specific guidelines appropriate for each jobsite.
- It is the responsibility of each organization, its supervision and each employee to ensure compliance with this training program and all appropriate Federal, State, and City safety and health codes, rules, regulations and standards.

Why Does This Matter In Construction?

- Rapid adoption of lithium-powered tools and equipment
- Increased fire incidents on jobsites
- Consequences: injuries, property loss, project shutdowns

Lithium-ion battery from drill explodes and causes $100,000 worth of damage in Melbourne home

The explosion started a fire which caused about $100,000 worth of damage.


CHAPEL HILL
FIRE DEPT.
19 SAFETY ALERT
LITHIUM-ION BATTERY DANGERS
6:12
25°
19
19 DOWNLOAD OUR NEWS APP
PARMA
NOW 25
11PM 23
6AM 27

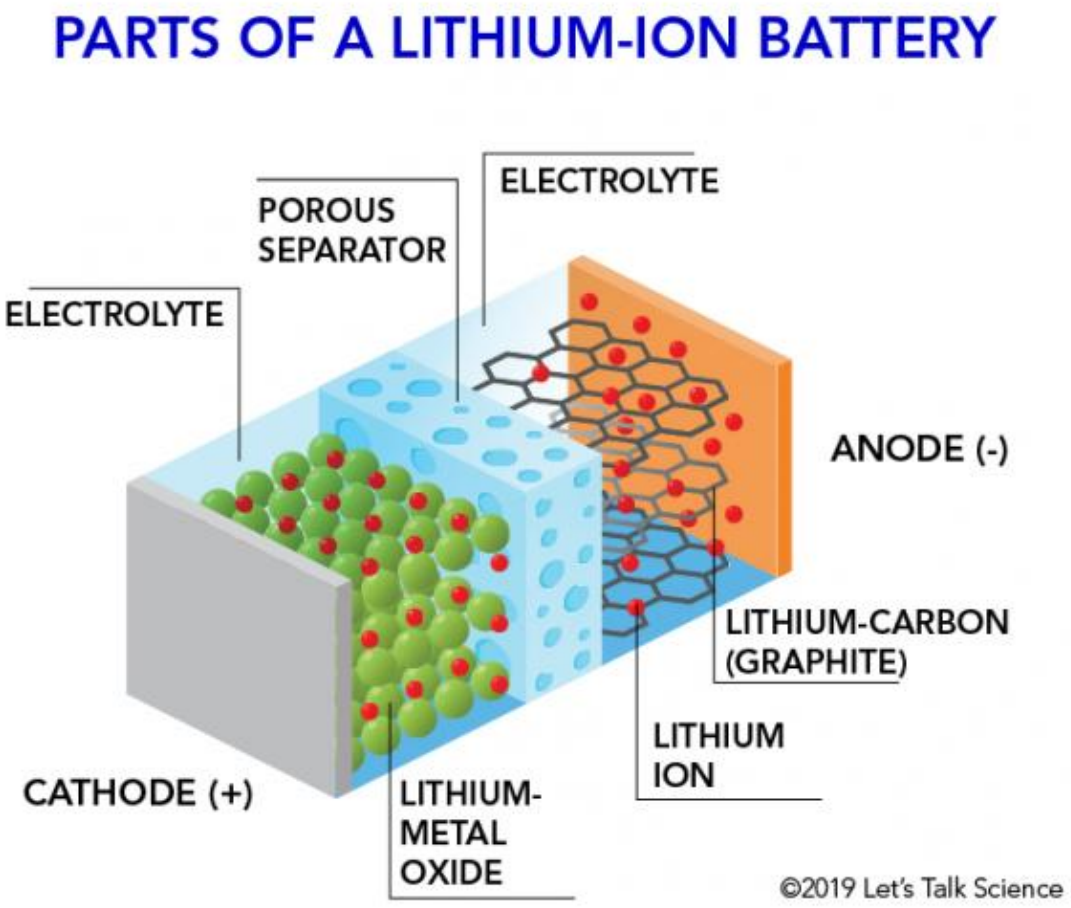

Garden Spot Fire Rescue
8
WGAL

What is Lithium-Ion

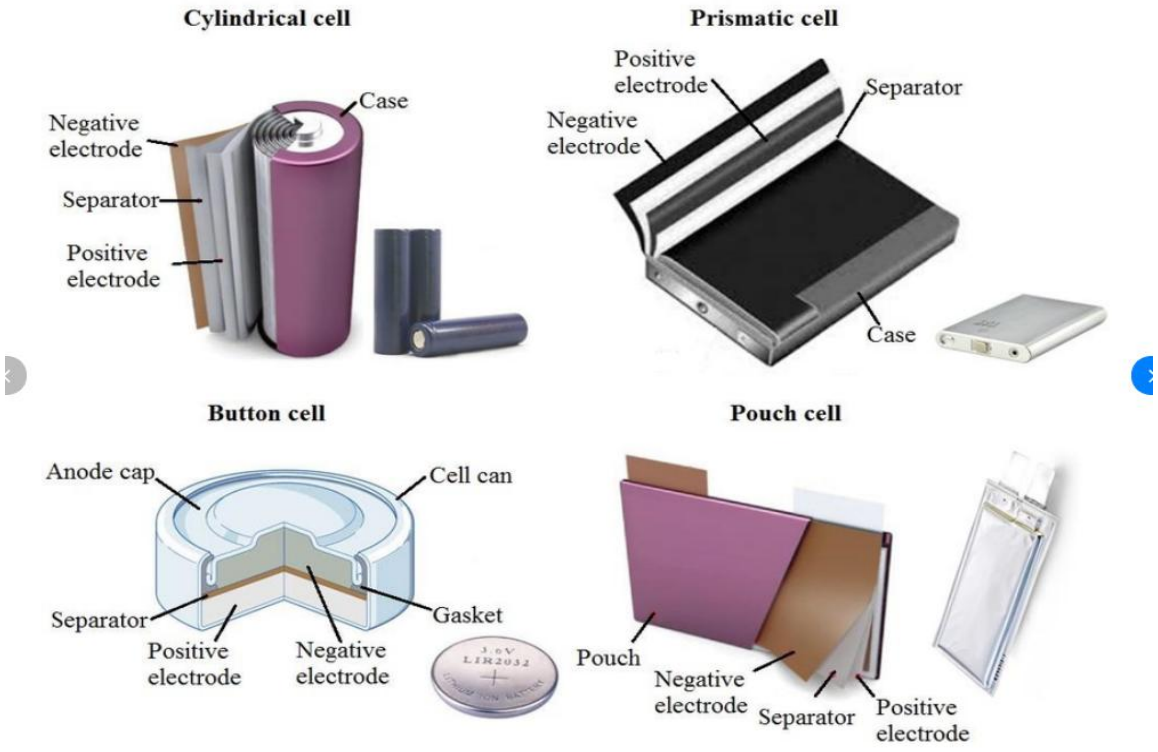
- **Definition:** A lithium-ion (Li-ion) battery is a rechargeable battery technology in which lithium ions move between electrodes during charge and discharge; these cells are commonly connected in packs in tools and equipment.

Lithium-Ion Battery Cell Components

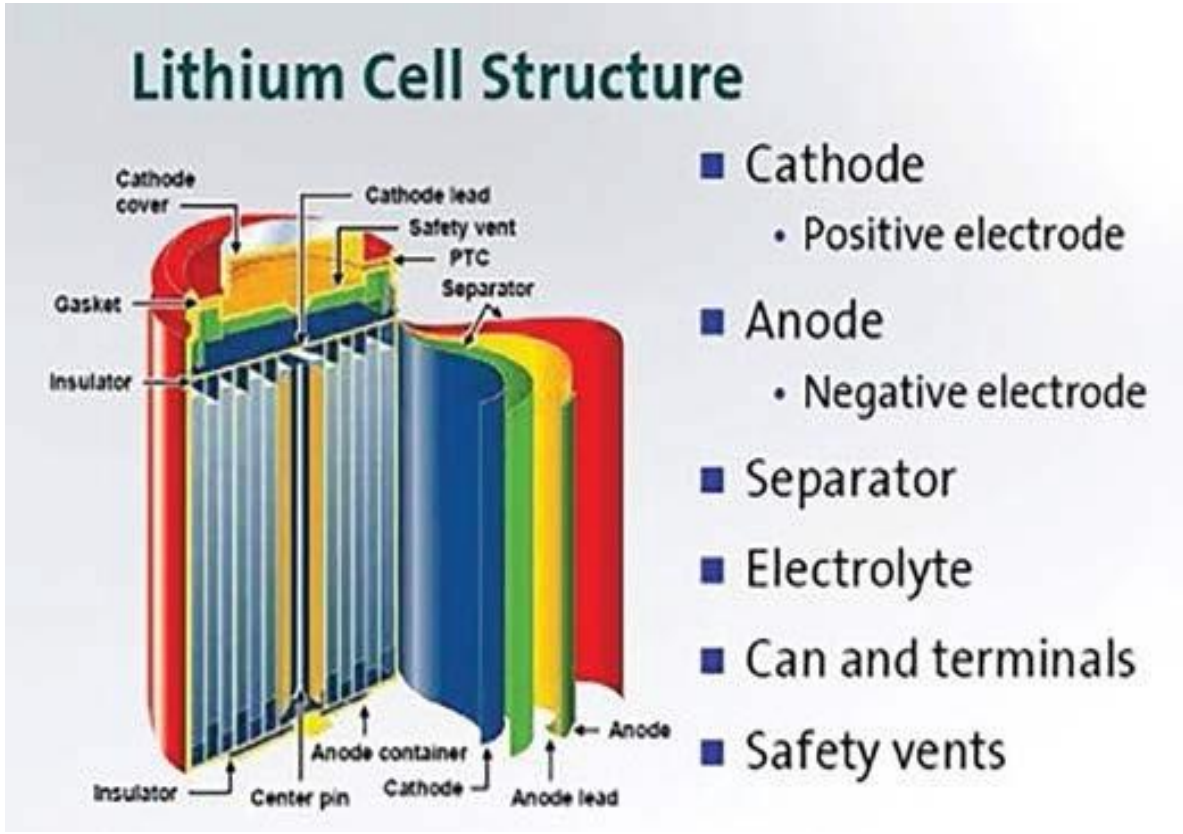
- Two (2) Electrodes- Cathode and Anode
- Electrolyte
  - Lithium salt dissolved in an organic solvent (very flammable)
  - Liquid or Gel
- Separator- prevents short- circuit between anode and cathode.



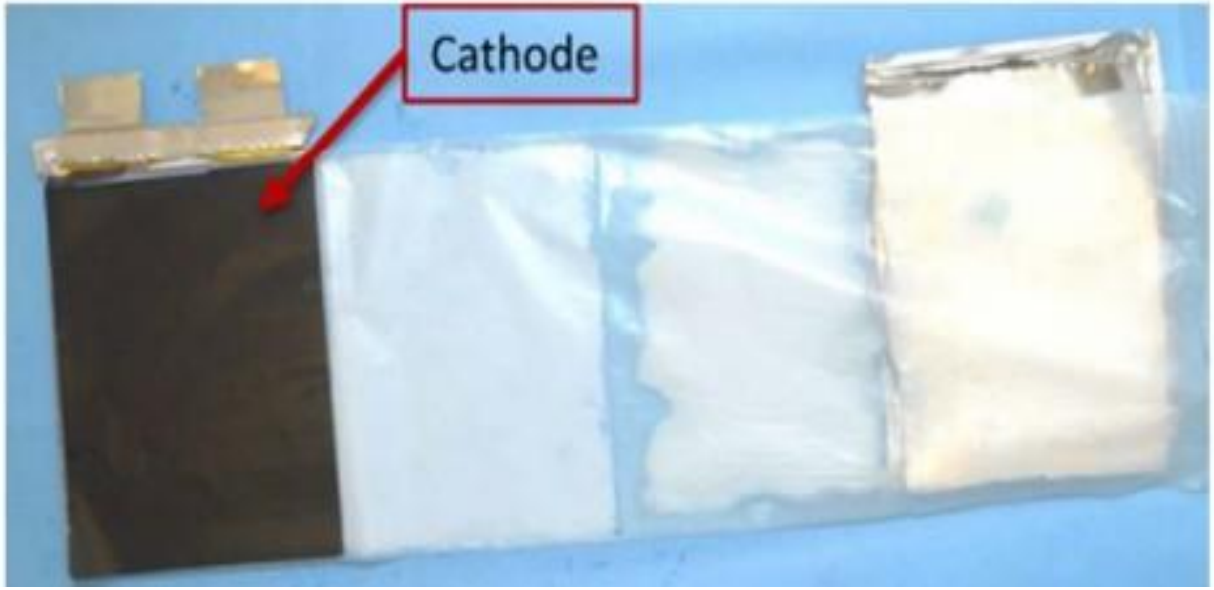
Lithium-Ion Cell Designs



5: The most common lithium-ion cell types.

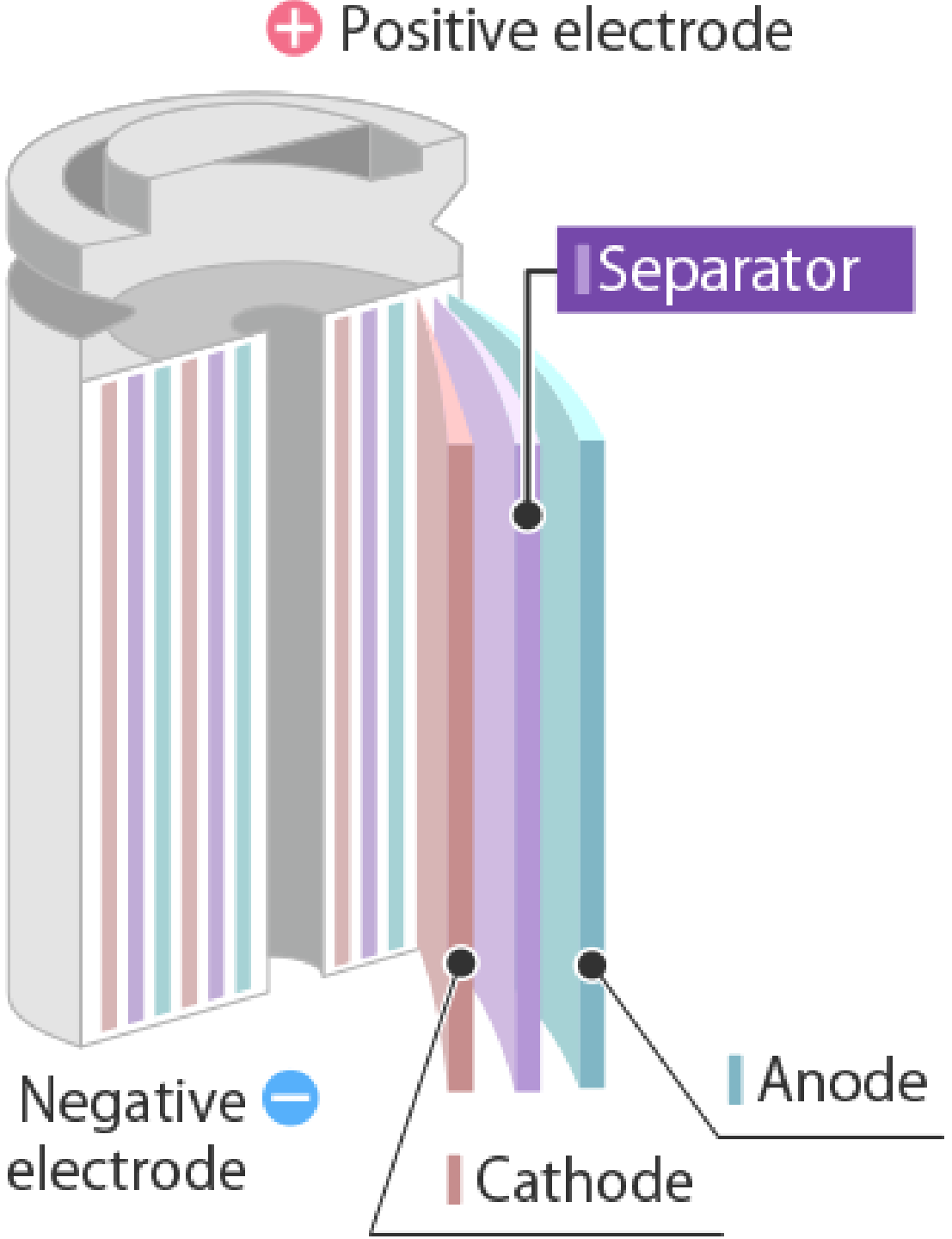


Lithium-Ion Battery Cell Components



Separator

- Permeable barrier between the electrodes that prevents internal short-circuiting and allowing the electrolyte to transfer charged ions between the electrodes.
- Failure of separator leads to failure of the battery cell.



Common Construction Applications:

- Cordless power tools
- Lifts and mobile equipment
- Temporary power and lighting
- Backup energy storage systems

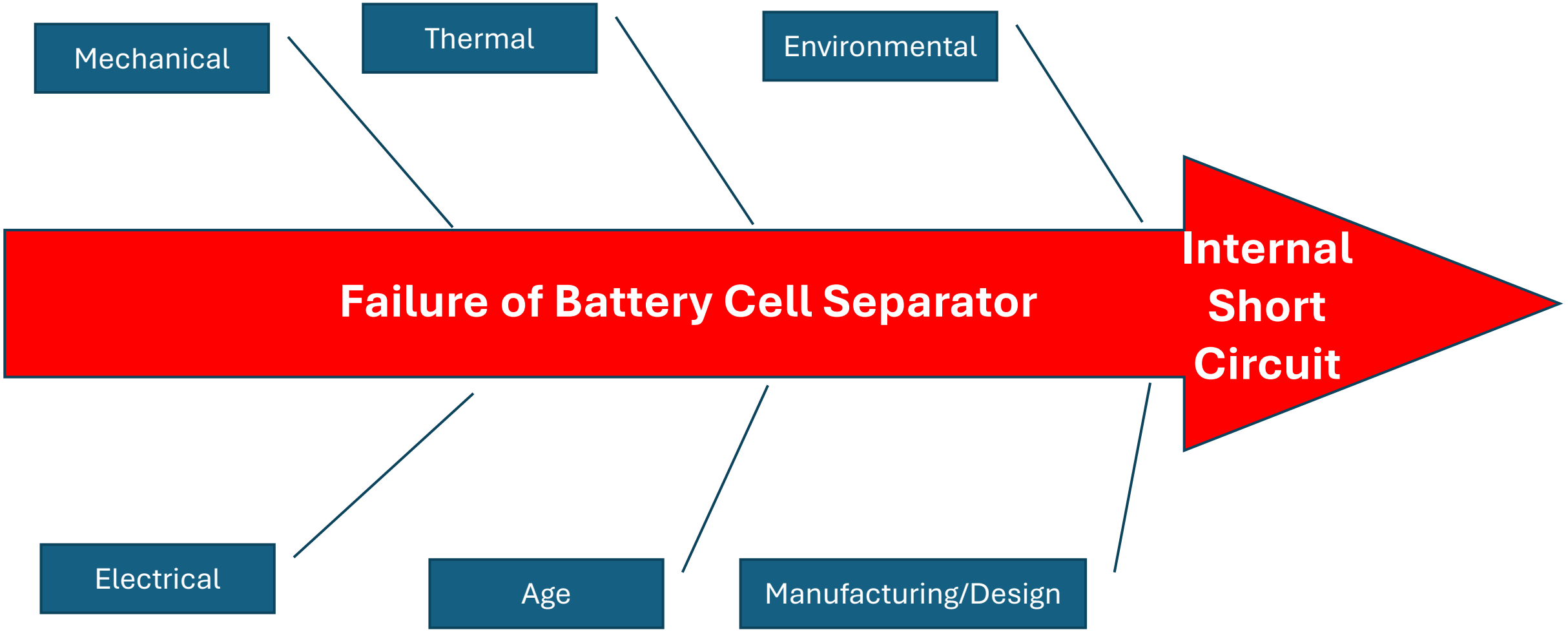
Why Lithium-Ion Is Inherently Hazardous:

- Stores large amounts of energy in small space
- Flammable electrolyte
- Sensitive to heat, impact, overcharging, and defects
- Water & Moisture is BAD!

Triggers of Thermal Runaway:

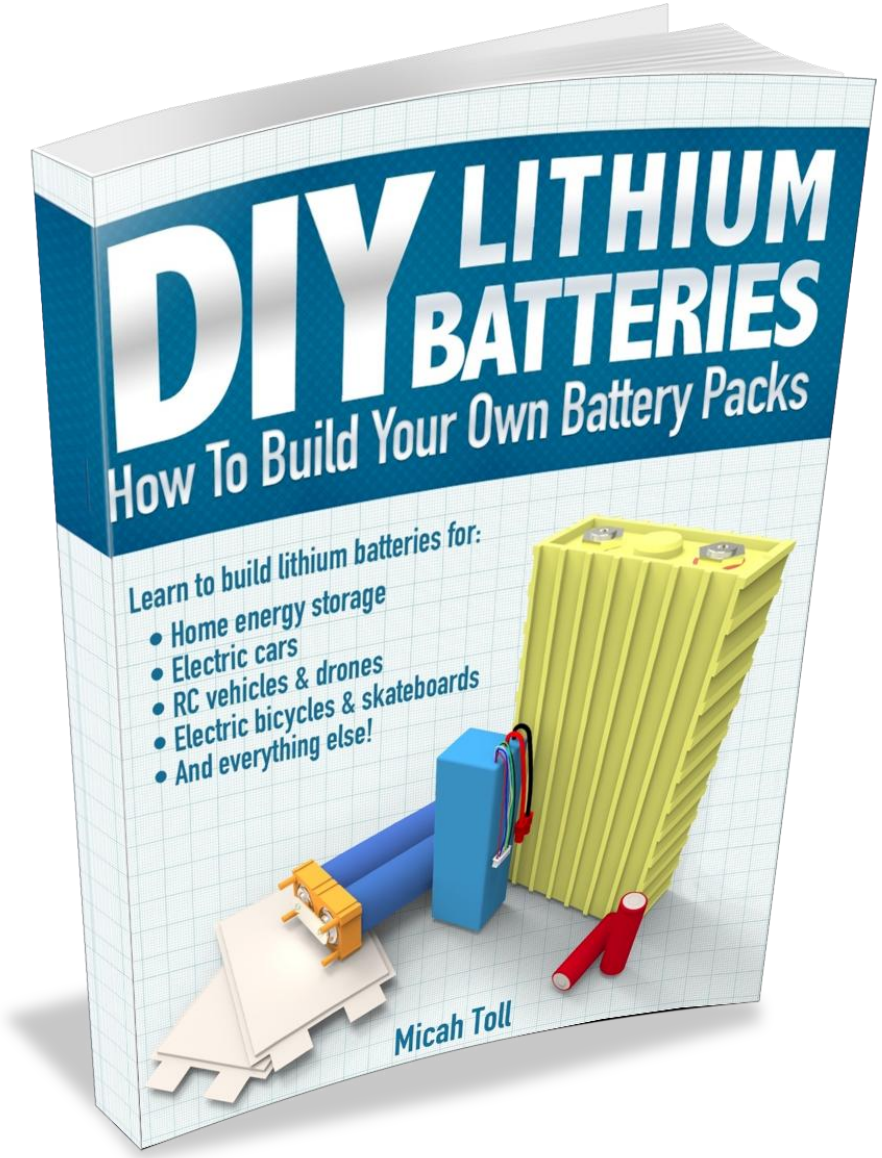
- Overcharging
- Physical damage (drops, crushing)
- Exposure to heat
- Manufacturing defects
- Use of non-OEM chargers

Initiating Event



Contributing Human Factors

- Unsafe Charging Practices
- Physical Abuse
- Build Own Battery Packs
- Low quality charging devices and replacement battery packs.



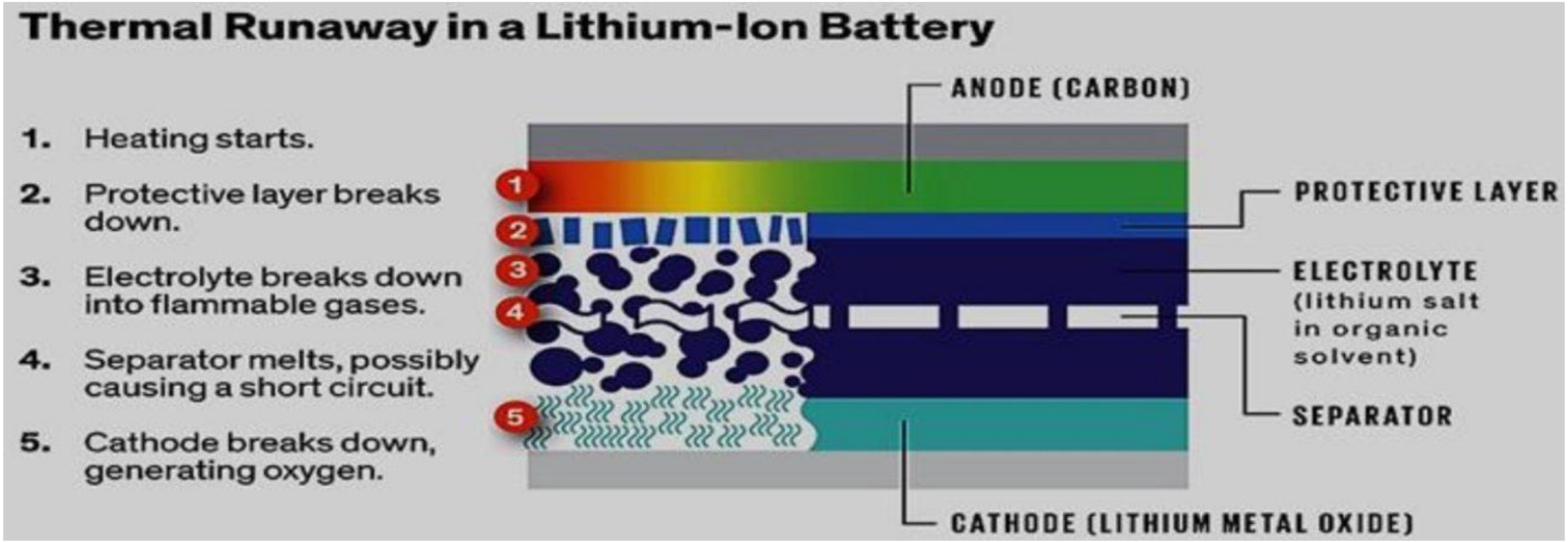
WARNING

USING A DAMAGED BATTERY IN YOUR POWER TOOLS CAN CAUSE VIOLENT FIRE IN SECONDS.


Cell Failure
Thermal Runaway
Propagation

Thermal Runaway

A phenomenon in which the lithium-ion cell enters an **uncontrollable, self-heating state.**



Thermal Runaway- Stages

Initiating Event

Off-Gas Generation

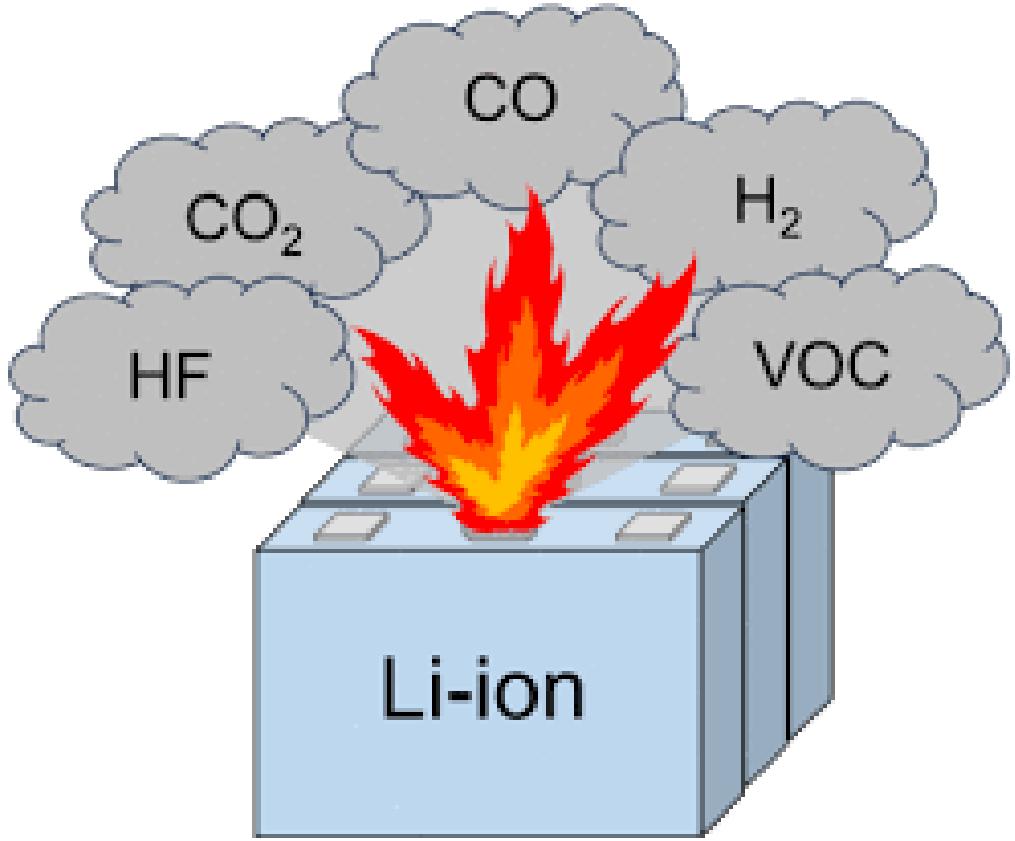
Smoke Generation

Fire Generation


OXIC

Off-Gassing


rcinogen
substance that has the
tential to cause cancer
iving tissues


CO
CO_2
H_2
HF
VOC
Li-ion

Off-Gassing

Flammable	Toxic	Corrosive
Hydrogen	Carbon Monoxide	Hydrogen Fluoride
Methane	Carbon Dioxide	
Ethylene		

GUIDE 147 Lithium Ion Batteries

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- Lithium ion batteries contain flammable liquid electrolyte that may vent, ignite and produce sparks when subjected to high temperatures (> 150°C (302°F)), when damaged or abused (e.g., mechanical damage or electrical overcharging).
- May burn rapidly with flare-burning effect.
- May ignite other batteries in close proximity.

HEALTH

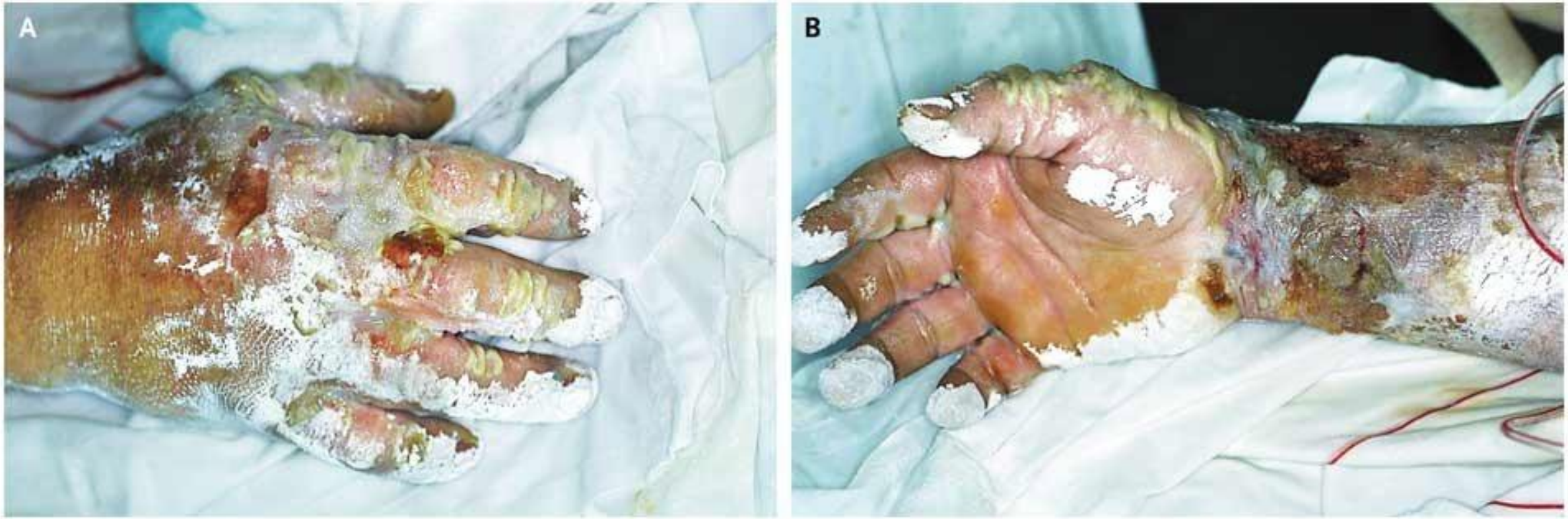
- Contact with battery electrolyte may be irritating to skin, eyes and mucous membranes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Burning batteries may produce toxic hydrogen fluoride gas (see GUIDE 125).
- Fumes may cause dizziness or asphyxiation.

Hydrogen Fluoride (HF)

- Extremely Corrosive
- Readily penetrates the tissue, destroys tissue, and decalcify bone.
- Burns are extremely painful and slow to heal.
- Systemic fluoride poisoning may also occur.
- Low concentrations- delayed affect hours after exposure.

Calcium Gluconate Gel

Calcium Gluconate Gel



Battery Inspection:

- Swelling
- Bulging
- Cracks
- Hissing or odor
- Heat during charging

Why OEM Chargers Matter:

- **Definition:** An **OEM (Original Equipment Manufacturer) charger** is the charger specifically designed, tested, and recommended by the battery/tool manufacturer for that exact make and model.

Why OEM Chargers Matter:

- **Importance:** OEM chargers implement proper voltage, current, and thermal control to protect the battery from overcharging, overheating, and instability. Using non-OEM or uncertified chargers can lead to improper charging behavior, increasing risk of electrical abuse and thermal runaway.

Safe Charging Practices:

- Designated charging areas
- Non-combustible surfaces
- Adequate spacing
- Do not charge unattended

Emergency Response:

- LIFE SAFETY - Evac
- Call 911
- Notify site supervision
- Establish exclusion zone
- Fight the Fire?

Fire Extinguishment Response:

- **Cooling Is Critical:** The principal strategy for lithium-ion fires is *cooling the cells* to interrupt thermal runaway. High volumes of water applied as a cooling medium are often necessary to absorb heat and prevent adjacent cell propagation.

Fire Extinguishment Response:

- **ABC Extinguisher Limitations:**
  - Standard ABC (dry chemical) extinguishers can suppress visible flames, but they **do not cool internal cells sufficiently** to stop thermal runaway, and fires can reignite.
- They also do not address *internal heat generation* and are not effective at halting cell-to-cell propagation.

Fire Extinguishment Response:

- **Recommended Techniques:** Bulk water application or specialized agents that both suppress fire and remove heat; establishing exclusion zones and letting large fires burn under control with continuous cooling are common practices.

Key Hazard Recap:

- Thermal runaway
- Fire intensity
- Reignition risk

Prevention is Critical:

- Proper equipment
- Inspections
- Controlled charging

Emergency Response Essentials:

- Life Safety First
- Correct extinguishment approach
- Post-incident monitoring

Final Message:

- Lithium-ion batteries are powerful tools
- Mismanagement can be catastrophic
- Knowledge and controls save lives and jobsites

QUESTIONS:

THANK YOU!

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