What is all this stuff About Battery Fires?

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Types of Batteries

- Carbon Zinc
- Lead Acid
- Nickol Cadmium NiCd
- Nichol Metal Hydride NiMH
- Lithium Li
  - Lithium Ion
  - LiPo
  - LiFePO4

Capacity

- Carbon Zinc
- Lead Acid — 25 W-Hr /Kg
- Nichol Metal Hydride — 100 W-Hr /Kg (60-70 typical)
- Lithium — 150 W-Hr /Kg

Carbon Zinc

- The FIRST “dry” battery
- Single use primary battery (ie no recharge)

Lead Acid

- Flooded Cell
- Gell Cell
- Absorbed Glass Mat, AGM

Lead ACid

- Flooded Cell — 50% loss per month
- Gel Cell — 40% loss per month
- AGM — 10% loss per month

NiCd

- Memory effect

NiMH

- 20% loss per month

Lithium batteries

- Li ion or LiCoO2 Li cobalt 3.7 v/cell
- Li po or Lithium polymer 3.7 v/cell
- LiFePo4 Li iron phoshate 3.2 v/cell

Li ion
LiCoO2 Lithium Cobalt Oxide
LiPo is similar

- .1% loss per month
- No memory effect
- Start to degrade at the factory
- “2 to 3 year lifetime” per reports
- HEAT is a killer for degradation
- Complete discharge = toast
- MUST have onboard computer management
- Undercharge or overcharge = FIRE !

Batteries produced with $LiCoO_2$

- while providing higher capacity,
  - are more reactive and
  - Have have poorer thermal stability
- Susceptible to thermal runaway
  - If abused
  - or overcharged
- high temperatures (>130 deg C)
- At high temps generates O2
  - Reactw with organic electrolyte
  - EXOTHERMIC reaction = FIRE !!

Movie of iPAD hammered

- Battery overcharge
- https://www.youtube.com/watch?v=B-AoAYrEy-o

Simple Guidelines for Using Lithium-ion Batteries

- Lithium-ion batteries contain little lithium metal and in case of a fire they can be dowsed with water.
- If the fire of a burning lithium-ion battery cannot be extinguished, allow the pack to burn out in a controlled and safe way.
- Be aware of cell propagation as each cell might be consumed on its own time table when hot. Place a seemingly burned-out pack outside for a time.
- goal with the water is to drop the temp of the surrounding batteries so they don't overheat and vent.

Only lithium-metal batteries require a Class D extinguisher.

- If a Class D extinguisher is not available to douse a lithium-metal fire, only pour water to prevent the fire from spreading as water interacts with lithium.

- For best results dowsing a Li-ion fire, use a foam extinguisher, CO2, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate) as you would extinguish other combustible fires.

LiFePO4
Lithium Iron Phosphate

- Safer than Li ion
- thermal and chemical stability over Li ion
- Long cycle life 2000-7000 cycles
- Can be quick charged

Electric Vehicles

- Tesla S ran over a tow hitch in the road
  - Fixed by adding a skid plate under the pack.

Questions

How To
Extinguishing in flight computer laptop fires

- https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=video&cd=37&ved=0ahUKEwjGzeft1_zKAhXKrB4KHSU3Ba84HhC3Agg2MAY&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DvS6KA_Si-m8&usg=AFQjCNHezlg1YOQPXgIRZ2Wx0tQ3KiBlRQ&bvm=bv.114195076,d.dmo

Hitting cell phone with hammer

- https://www.youtube.com/watch?v=X4qJ8WcNGwg