

Lithium Battery Technology

1. Primary Lithium Batteries

A. What is a lithium battery?

In the last two decades, with the fast development of the electronic techniques, the requirements for batteries with low weight, high energy and strong adaptability become urgent.

Lithium batteries have gained popularity for their high energy, long storage life and wide temperature range (-20 +60 C).

Lithium batteries are widely applied in electronic meters, cameras and other personal digital equipment – and are the ideal power source for electronic equipment.

B. Classifications of lithium batteries

Lithium batteries can be divided into two classes: secondary and primary. Primary batteries can transform chemical energy into electrical energy, but not the reverse; they should not be recharged. Examples of primary lithium batteries are Li-MnO₂, lithium Thionyl chloride, etc... Secondary batteries are rechargeable, meaning they can transform electrical energy into chemical energy and store it; the reverse transformation is made when it is used, such as li-ion mobile phone batteries.

C. Energy density

The unique feature of lithium batteries is their high energy density, that is, the high energy of each unit of weight or volume. The gravimetric energy is shown by wh/kg and volumetric energy density by wh/l. wh -the unit of energy, w refers to voltage, and h refers to hour; kg is kilograms (the unit of weight) and L is liter (the unit of volume). For instance, the rating voltage of 5# nickel cadmium cell is 1.2 V, the capacity is 800mAh, while the energy is 0.96Wh (1.2V×0.8Ah). In contrast, the 5# Li-MnO₂ battery of the same size has a voltage rating of 3v, a capacity 1200mAh and 3.6Wh of energy. Although the two batteries have the same volume, the energy of the latter is 3.75 times that of the former.

D. Application scope of lithium batteries

The application of lithium batteries includes palmtops, portable computers, PDAs, communication instruments, cameras, satellites, rockets, fish torpedoes and other apparatus.

E. Li - MnO₂ batteries

Li -MnO₂ batteries are primary batteries with lithium as the negative electrode, MnO₂ as the positive electrode and organic solvent as electrolyte. The main feature is the high voltage. The nominal voltage is 3v (2 times that of the common dry battery); the expiration discharge voltage is 2v, the specific capacity is high; the discharge voltage is stable and reliable; the shelf life is more than 3 years, the self discharge rate is low ($\leq 2\%$ annually), and the working temperature ranges from (-20 +60 C). The battery can be made into different shapes (rectangular, cylindrical and Coin) to meet various requirements.

Coin Batteries are often used in clocks, calculators, electronic notepads, audiphones, electronic game machines, IC cards, standby power sources, etc.

F. Li-SOCl₂ batteries

Li-SOCl₂ batteries have the highest specific energy, reaching levels of 500Wh/kg. Their nominal voltage is 3.6v when discharging at the mediate current. Their voltage is quite stable at 3~4 v (it can discharge stably with little change within the 90% capacity). They can work at a range of -40 ~ +85 C, while at - 40 , the capacity is about 50% of that at normal temperature. Their self-discharge rate is low ($\leq 1\%$), and shelf life can reach more than 10 years.

G. Application Warnings

The above lithium batteries are primary and cannot be recharged. Never short circuit by directly connecting the positive and negative terminals. Never discharge at a current exceeding the maximum current. Do not extrude, burn, or tear down when expired. Do not use beyond the temperature range of -40 ~ +85 C.

H. Primary batteries

Lithium manganese dioxide coin battery
Lithium manganese dioxide cylindrical battery
Lithium Thionyl chloride battery

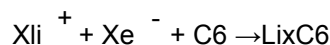
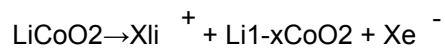
2. Secondary Lithium Batteries

A. Li-ion Battery

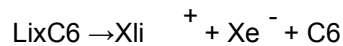
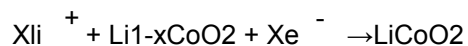
When a li-ion battery is charged, the li-ion is released from the positive electrode into the electrolyte, and then into the negative electrode. The reverse process takes place when the battery is discharged.

B. The working principle of a lithium battery:

Charge:



Discharge:



C. Differences between Li-ion, Ni-Cd and Ni-MH batteries:

	Ni-Cd	Ni-MH	Li-ion
Working volts (V)	1.2	1.2	3.6
Gravimetric Energy density(wh/kg)	50	65	100~160
Volumetric Energy density (wh/l)	150	200	250~300
Cycle life	500	500	500
-20% capacity	80%	60%	80%
self discharge rate (%month)	25~30	30~35	<10%)
Memory effect	High	Low	none

D. Li-ion battery safety

Because the lithium element in the battery is in a state of ion instead of metal, safety is improved to a large extent. In accordance with the US UL and UN CE certificates, our batteries have passed all relevant safety tests, which include short circuit, overcharge, shock, high temperature, etc.

E. Li-ion battery types

1. Prismatic: mainly applied in portable instruments, e.g. mobile phones, laptops, video cameras, etc.
2. Coin: mainly applied in blue-tooth applications, e.g. wireless earphones.
3. Power: li-ion batteries with a capacity larger than 3AH, which can be divided into two types: high capacity and high power. High capacity li-ion batteries are mainly applied in electric tools, bicycles, lamps, medical equipment, etc.; High power Li-ion batteries are mainly applied in hybrid powered vehicles and other applications requiring high charging and discharging current.

3. Questions and answers

A. Can Lithium batteries be exposed to fire?

It is dangerous to expose any battery to fire or other high temperature environments – doing so could possibly cause explosion.

B. Is it ok to use new batteries and used batteries together?

No, this will shorten the life all of batteries.

C. Is it ok to use batteries of different types in one instrument?

No, this may damage the instrument or cause invalidation of the batteries. Make sure to select the battery type specified by the manufacturer.

D. Can used batteries be discarded?

Even though lithium batteries are green products without lead, cadmium, or Hg, we would recommend contacting your local battery recycling authority.