Lithium Ion Battery

Background [edit]

Lithium batteries were proposed by British chemist M. Stanley Whittingham, now at Binghamton University, while working for Exxon in the 1970s.[24] Whittingham used titanium(IV) sulfide and lithium metal as the electrodes. However, this rechargeable lithium battery could never be made practical. Titanium disulfide was a poor choice, since it has to be synthesized under completely sealed conditions, also being quite expensive (~$1,000 per kilogram for titanium disulfide raw material in 1970s). When exposed to air, titanium disulfide reacts to form hydrogen sulfide compounds, which have an unpleasant odour and are toxic to most animals. For this, and other reasons, Exxon discontinued development of Whittingham's lithium-titanium disulfide battery.[25] Batteries with metallic lithium electrodes presented safety issues, as lithium metal reacts with water, releasing flammable hydrogen gas.[26] Consequently, research moved to develop batteries in which, instead of metallic lithium, only lithium compounds are present, being capable of accepting and releasing lithium ions.

Varta lithium-ion battery, Museum Autovision, Altlussheim, Germany

A **lithium-ion battery** or **Li-ion battery** (abbreviated as **LIB**) is a type of rechargeable battery. Lithium-ion batteries are commonly used for portable electronics and electric vehicles and are growing in popularity for military and aerospace applications.[9] The technology was largely developed by John Goodenough, Stanley Whittingham, Rachid Yazami and Akira Yoshino during the 1970s–1980s,[10][11] and then commercialized by a Sony and Asahi Kasei team led by Yoshio Nishi in 1991.

- *2012* – John Goodenough, Rachid Yazami and Akira Yoshino received the 2012 IEEE Medal for Environmental and Safety Technologies for developing the lithium ion battery.[10]
- *2014* – John Goodenough, Yoshio Nishi, Rachid Yazami and Akira Yoshino were awarded the Charles Stark Draper Prize of the National Academy of Engineering for their pioneering efforts in the field.[71]

- *2019* – The Nobel Prize in Chemistry was given to John Goodenough, Stanley Whittingham and Akira Yoshino "for the development of lithium ion batteries".[11]

An 18650 size lithium ion battery, with an alkaline AA for scale. 18650 are used for example in notebooks or Tesla Model S


Nissan Leaf's lithium-ion battery pack.

Lithium-ion battery


A Li-ion battery from a Nokia 3310 mobile phone.

Specific energy	100–265 W·h/kg[1][2] (0.36–0.875 MJ/kg)
Energy density	250–693 W·h/L[3][4] (0.90–2.43 MJ/L)
Specific power	~250 – ~340 W/kg[1]
Charge/discharge efficiency	80–90%[5]
Energy/consumer-price	3.6 Wh/US$[6]
Self-discharge rate	0.35% to 2.5% per month depending on state of charge[7]
Cycle durability	400–1,200 cycles [8]
Nominal cell voltage	3.6 / 3.7 / 3.8 / 3.85 V, LiFePO4 3.2 V