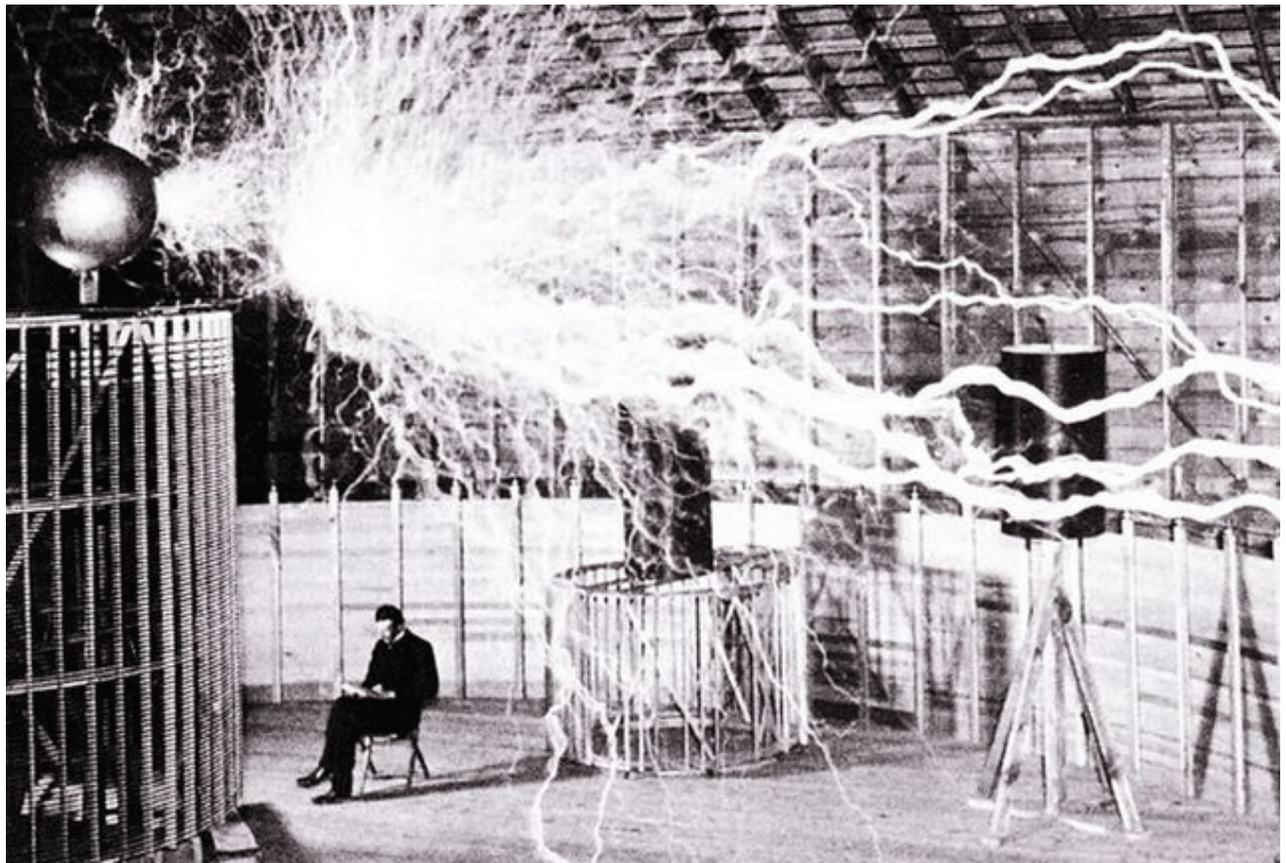
It will soon be possible to transmit wireless messages around the world so simply that any individual can carry and operate his own apparatus.

Nikola Tesla, 1909



Arizona State University
SES 194

Energy in Everyday Life

Batteries

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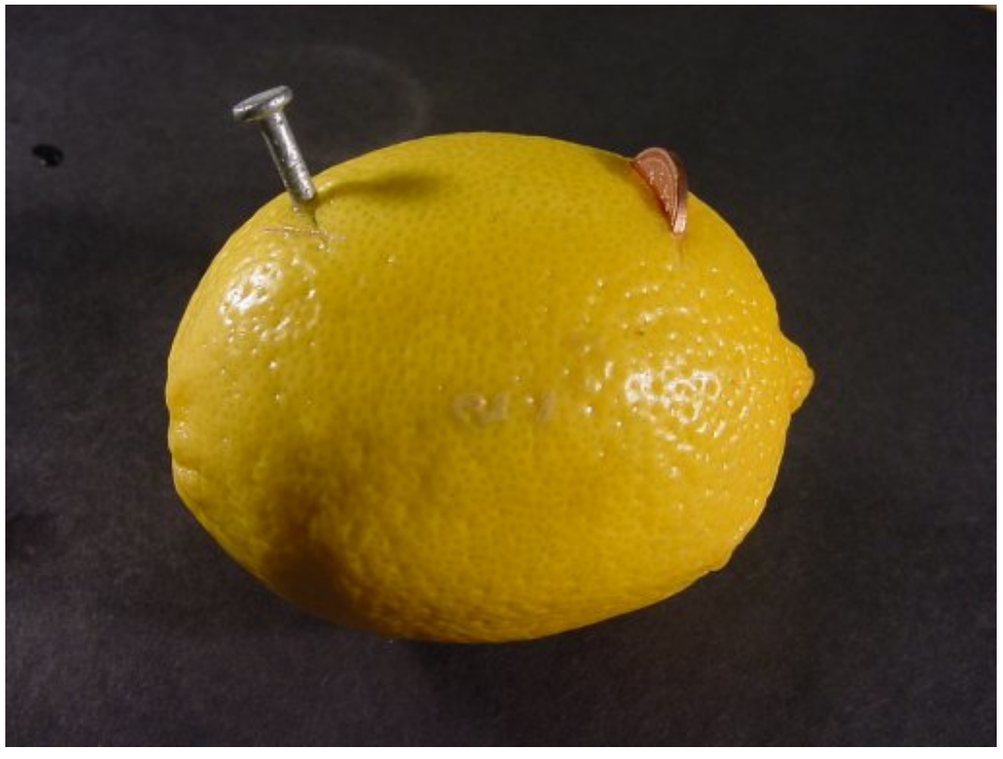
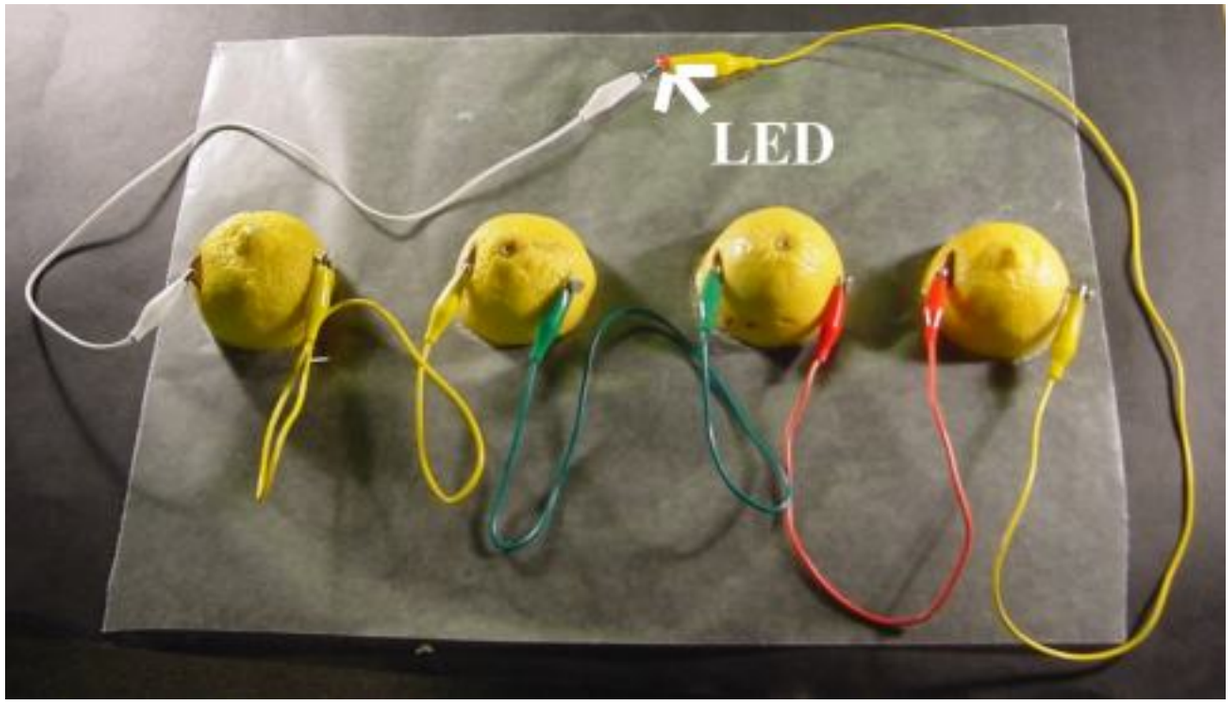
Batteries need two electrodes made of different materials and a electrolytic material to conduct charges between the electrodes.



The lemon battery works because lemon juice is an acid that conducts charges relatively easily. Any fruit juice, cider vinegar, wine vinegar and so on will work.

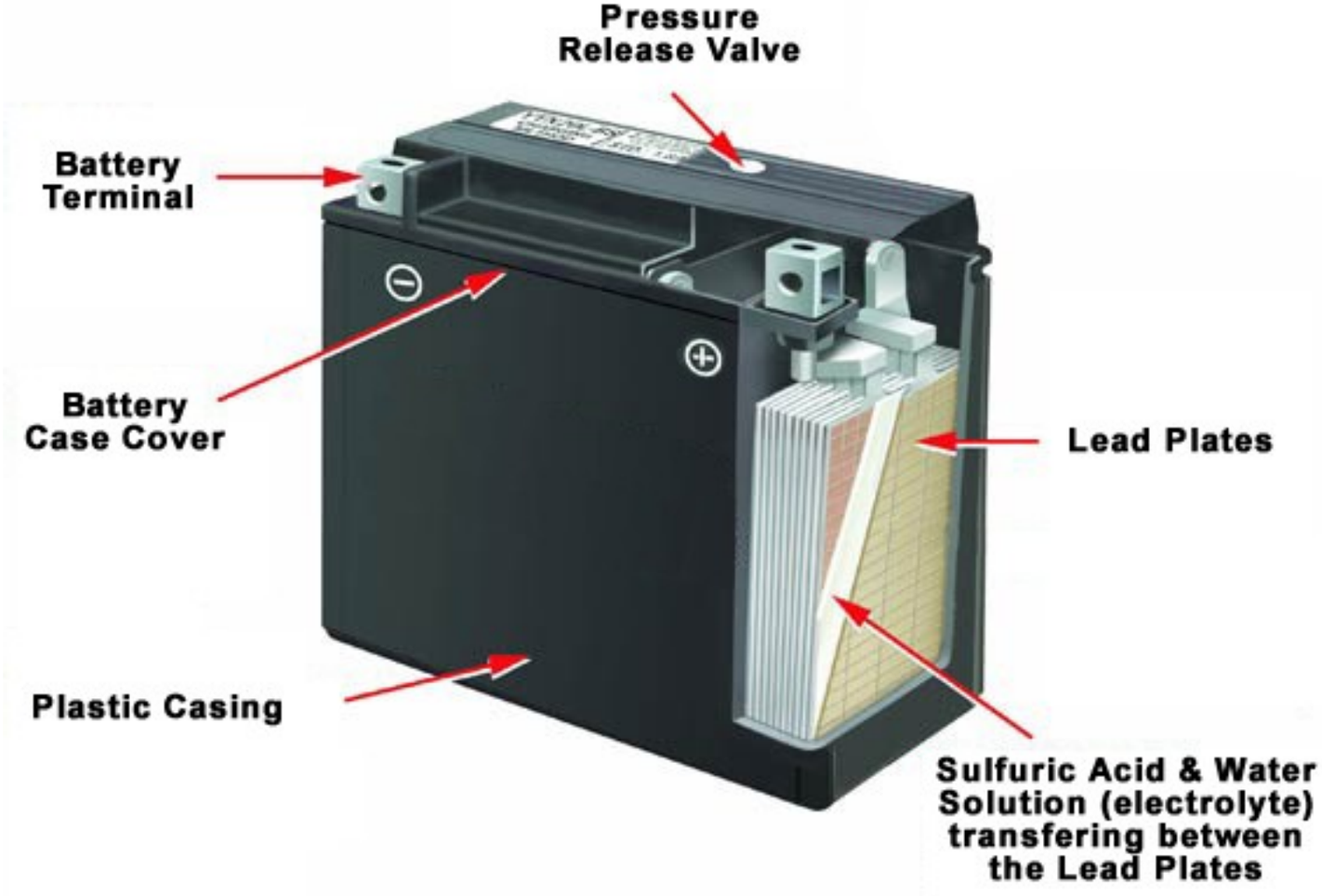
The battery is so named because any one cell, composed of two electrodes and an electrolyte, does not deliver much energy; a battery, or series, of cells connected together could deliver an appreciable energy between the ends.



Open acid batteries are not very practical because acid will spill if one attempts to move it much.

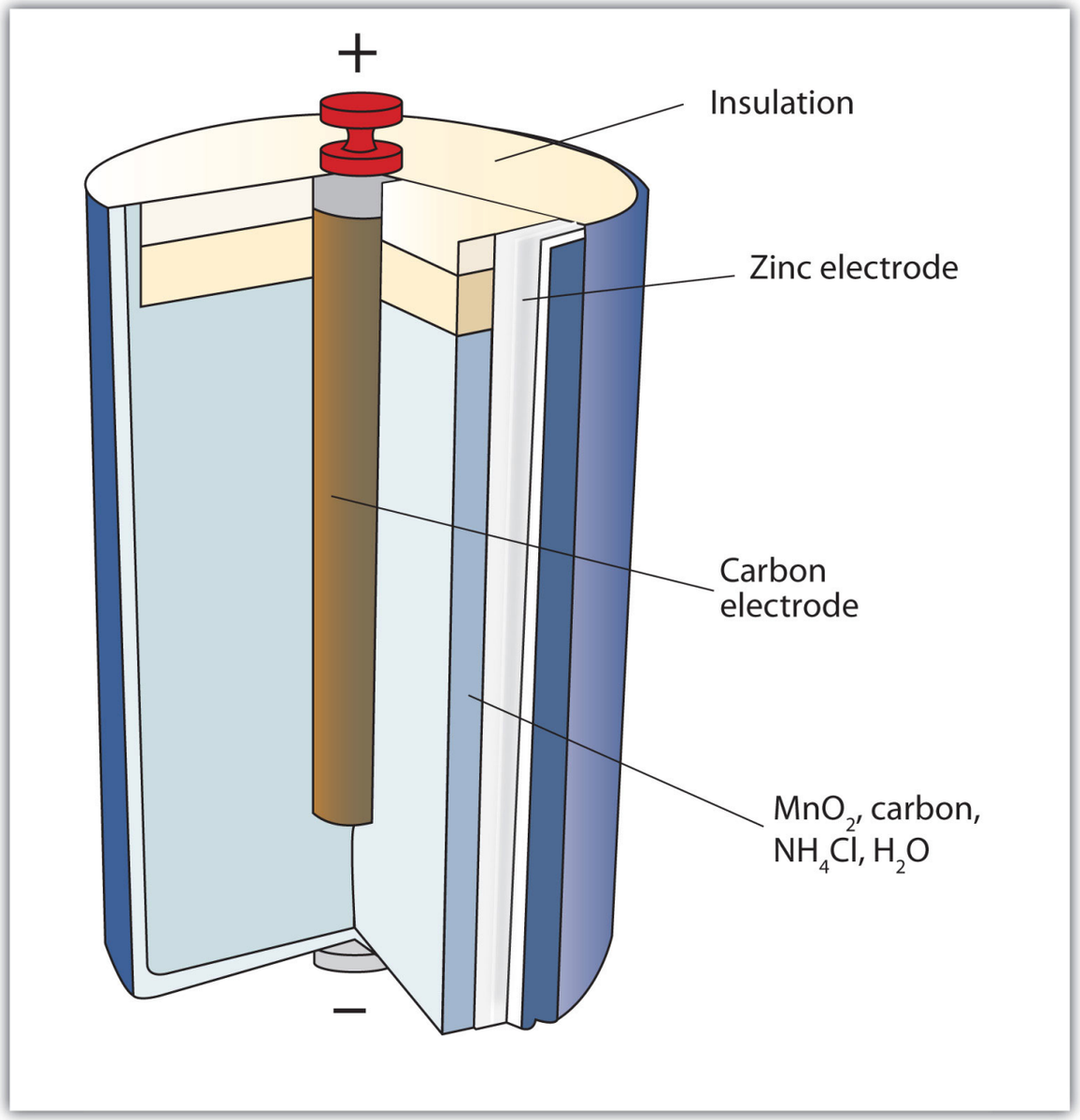
Several methods have been used to overcome this challenges.

For example, a container could be built so that a series of bimetal strips is held closely in the container, acid is put between the strips and the top is closed.



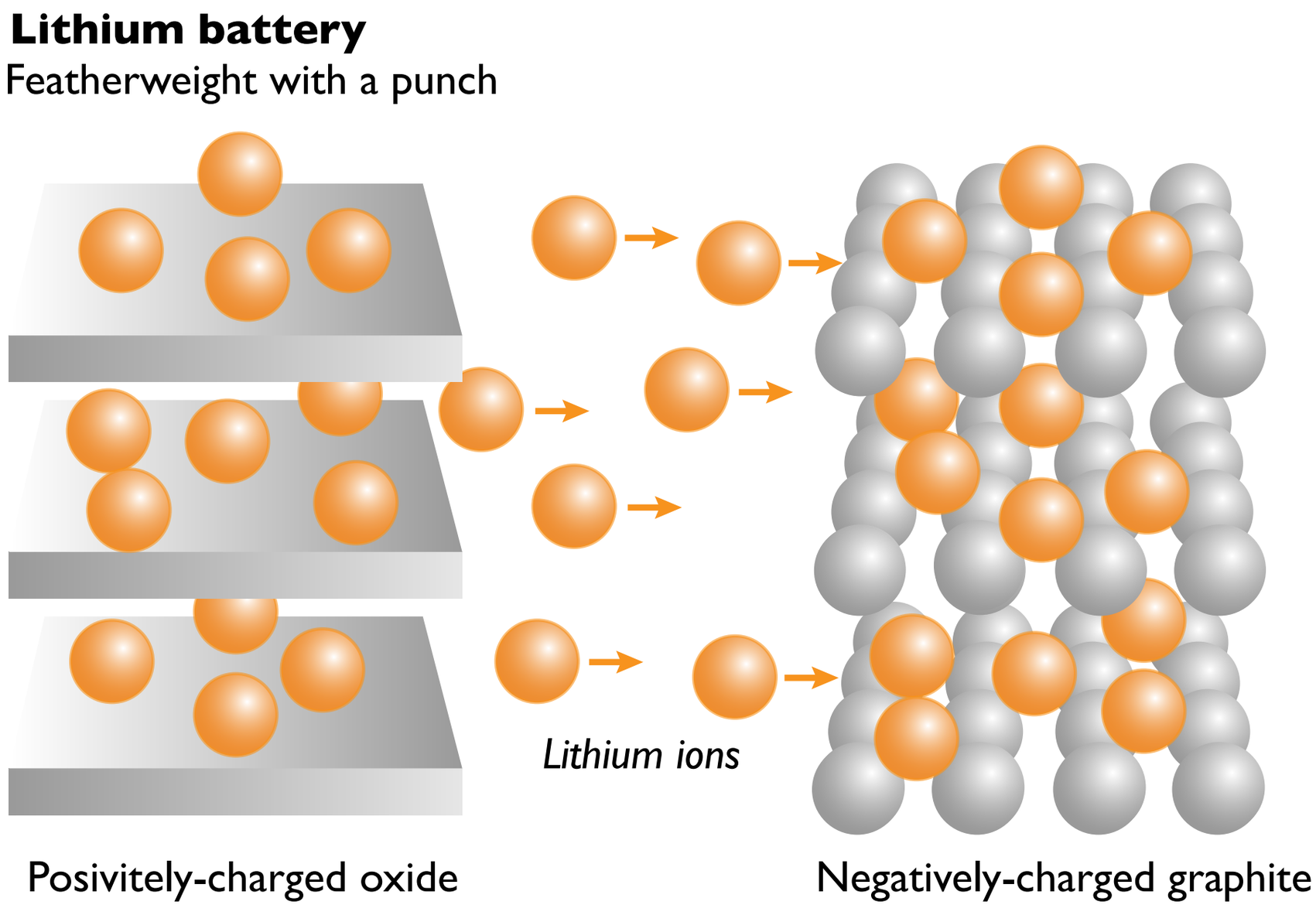
A dry cell flashlight battery is made so that the outer containers acts as one electrode and the other is replaces by a carbon rod in contact with the metal top, and a paste electrolyte fills the rest of the space.

A dry cell is not really dry, but moist; however, the acid contained in it will not spill.



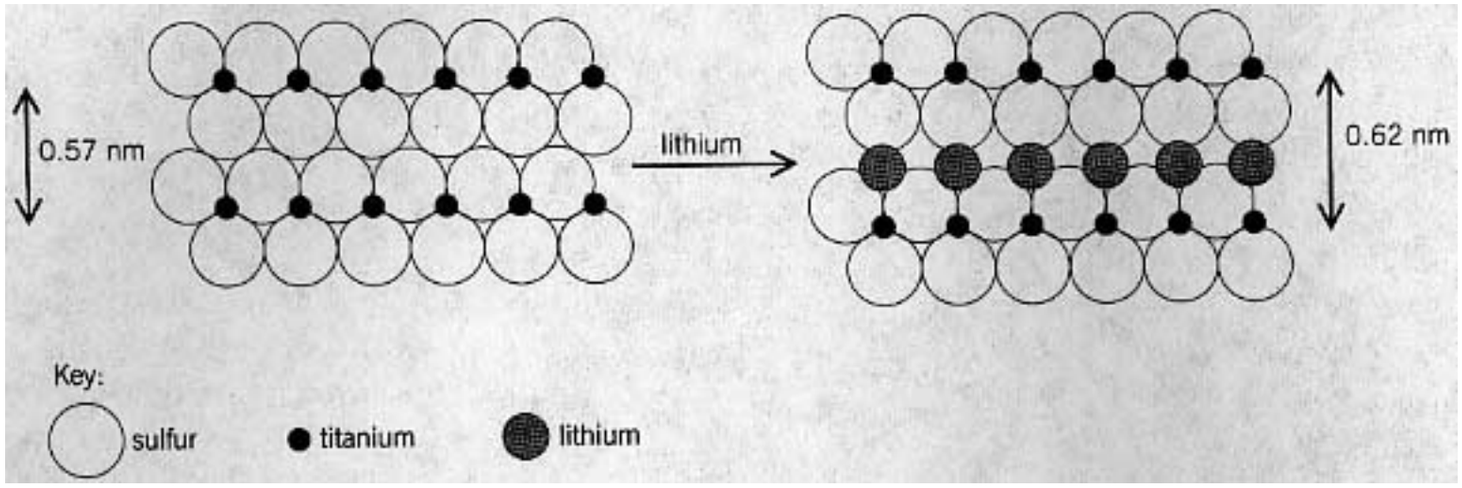
A lithium-ion (Li-ion) battery is a rechargeable battery in which lithium ions move from the negative to the positive electrode during discharge and back when charging.

Rechargeable Li-ion batteries use an intercalated lithium compound as the electrode material.



Intercalation is the reversible inclusion or insertion of a molecule (or ion) into compounds with layered structures.

Li-ion batteries were proposed by Stanley Whittingham, while working for Exxon in the 1975. Whittingham used titanium sulfide and lithium metal as the electrodes.



In 1977, Samar Basu showed intercalation of lithium in graphite.

In 1991 Sony and Asahi Kasei released the first commercial lithium-ion battery.

By 2013 the rechargeable Li-ion battery had progressed to a lithium vanadium phosphate battery to increase energy efficiency in the forward and reverse reaction.

In 2014, over 40% of portable electronics use Li-ion batteries.

In 2014 Li-ion batteries with 20% higher capacity, by using a silicon anode were being delivered to smartphone manufacturers.

Lithium-ion batteries can pose a safety hazard since they contain, unlike other rechargeable batteries, a flammable electrolyte and are also pressurized.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