Lithium iron phosphate battery diagram

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Manganese, phosphate, iron, and lithium also form an olivine structure. This structure is a useful contributor to the cathode of lithium rechargeable batteries.[7] This is due to the olivine structure created when lithium is combined with manganese, iron, and phosphate (as described above). The olivine structures of lithium rechargeable batteries are significant, for they are affordable, stable, and can be safely used to store energy.[8]

The material can be produced by heating a variety of iron and lithium salts with phosphates or phosphoric acid. Many related routes have been described including those that use hydrothermal synthesis.[15]

In LiFePO4, lithium has a +1 charge, iron +2 charge balancing the -3 charge for phosphate. Upon removal of Li, the material converts to the ferric form FePO4.[16]

LFP cells have an operating voltage of 3.3 V, charge density of 170 mAh/g, high power density, long cycle life and stability at high temperatures.[18]

LFP''s major commercial advantages are that it poses few safety concerns such as overheating and explosion, as well as long cycle lifetimes, high power density and has a wider operating temperature range. Power plants and automobiles use LFP.[19][20]

BAE has announced that their HybriDrive Orion 7 hybrid bus uses about 180 kW LFP battery cells. AES has developed multi-trillion watt battery systems that are capable of subsidiary services of the power network, including spare capacity and frequency adjustment. In China, BAK and Tianjin Lishen are active in the area.

The safety is a crucial property for certain applications. For example, in 2016 an LFP-based energy storage system was installed in Paiyun Lodge on Mt.Jade (Yushan) (the highest alpine lodge in Taiwan). As of 2024, the system is still operating safely.[3]

Although LFP has 25% less specific energy (Wh/g) than lithium batteries with oxide (e.g. nickel-cobalt-manganese, NCM) cathode materials, primarily due to its operational voltage (3.2 volts vs 3.7 for NCM-type cathode chemistries), it has 70% more than nickel-hydrogen batteries.

The major differences between LFP batteries and other lithium-ion battery types is that LFP batteries contain no cobalt (removing ethical and economic questions about cobalt''s availability) and have a flat discharge curve.

LFP batteries have drawbacks, originating from a high electronic resistivity of LFP, as well as the lower maximum charge/discharge voltage. The energy density is significantly lower than $LiCoO_2$ (although higher than the nickel-metal hydride battery).

Lithium cobalt oxide based battery chemistries are more prone to thermal runaway if overcharged and cobalt is both expensive and not widely geographically available. Other chemistries such as nickel-manganese-cobalt (NMC) have supplanted LiCo chemistry cells in most applications. The original ratio of Ni to Mn to Co was 3:3:3, whereas today, cells are being made with ratios of 8:1:1 or 6:2:2, whereby the Co content has been drastically reduced.

On April 7, 2006, A123 filed an action seeking a declaration of non-infringement and invalidity UT"s patents. A123 separately filed two ex parte Reexamination Proceedings before the United States Patent and Trademark Office (USPTO), in which they sought to invalidate the patents based upon prior art.