Lfp lithium battery

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The specific energy of LFP batteries is lower than that of other common lithium-ion battery types such as nickel manganese cobalt (NMC) and nickel cobalt aluminum (NCA). As of 2024, the specific energy of CATL"s LFP battery is currently 205 watt-hours per kilogram (Wh/kg) on the cell level.[13] BYD"s LFP battery specific energy is 150 Wh/kg. The best NMC batteries exhibit specific energy values of over 300 Wh/kg. Notably, the specific energy of Panasonic"s "2170" NCA batteries used in Tesla"s 2020 Model 3 mid-size sedan is around 260 Wh/kg, which is 70% of its "pure chemicals" value. LFP batteries also exhibit a lower operating voltage than other lithium-ion battery types.

Negative electrodes (anode, on discharge) made of petroleum coke were used in early lithium-ion batteries; later types used natural or synthetic graphite.[26]

The LFP battery uses a lithium-ion-derived chemistry and shares many advantages and disadvantages with other lithium-ion battery chemistries. However, there are significant differences.

Iron and phosphates are very common in the Earth"s crust. LFP contains neither nickel[33] nor cobalt, both of which are supply-constrained and expensive. As with lithium, human rights[34] and environmental[35] concerns have been raised concerning the use of cobalt. Environmental concerns have also been raised regarding the extraction of nickel.[36]

A 2020 report published by the Department of Energy compared the costs of large scale energy storage systems built with LFP vs NMC. It found that the cost per kWh of LFP batteries was about 6% less than NMC, and it projected that the LFP cells would last about 67% longer (more cycles). Because of differences between the cell"s characteristics, the cost of some other components of the storage system would be somewhat higher for LFP, but in balance it still remains less costly per kWh than NMC.[37]

In 2020, the lowest reported LFP cell prices were $80/kWh (12.5 Wh/$) with an average price of $137/kWh,[38] while in 2023 the average price had dropped to $100/kWh.[39]By early 2024, VDA-sized LFP cells were available for less than RMB 0.5/Wh ($70/kWh), while Chinese automaker Leapmotor stated it buys LFP cells at RMB 0.4/Wh ($56/kWh) and believe they could drop to RMB 0.32/Wh ($44/kWh).[40] By mid 2024, assembled LFP batteries were available to consumers in the US for around $115/kWh.[41]

LFP chemistry offers a considerably longer cycle life than other lithium-ion chemistries. Under most conditions it supports more than 3,000 cycles, and under optimal conditions it supports more than 10,000 cycles. NMC batteries support about 1,000 to 2,300 cycles, depending on conditions.[6]

LFP cells experience a slower rate of capacity loss (a.k.a. greater calendar-life) than lithium-ion battery chemistries such as cobalt (LiCoO2) or manganese spinel (LiMn2O4) lithium-ion polymer batteries (LiPo battery) or lithium-ion batteries.[42]

The energy density (energy/volume) of a new LFP battery as of 2008 was some 14% lower than that of a new LiCoO2 battery.[45] Since discharge rate is a percentage of battery capacity, a higher rate can be achieved by using a larger battery (more ampere hours) if low-current batteries must be used.

Higher discharge rates needed for acceleration, lower weight and longer life makes this battery type ideal for forklifts, bicycles and electric cars. Twelve-volt LiFePO4 batteries are also gaining popularity as a second (house) battery for a caravan, motor-home or boat.[49]

Tesla Motors uses LFP batteries in all standard-range Models 3 and Y made after October 2021[50] except for standard-range vehicles made with 4680 cells starting in 2022, which use an NMC chemistry.[51]

As of September 2022, LFP batteries had increased its market share of the entire EV battery market to 31%. Of those, 68% were deployed by two companies, Tesla and BYD.[52]

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