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EV Batteries: Improvements Coming Soon

Advanced Battery Technologies

Manufacturers are developing advanced battery technologies to reduce battery size and weight, and to improve battery function and safety.

Solid-state batteries

Solid-state batteries offer several advantages over traditional lithium ion (Li-ion) batteries: higher energy density, improved safety, and longer lifespan.

Samsung Advanced Institute of Technology is developing a solid-state battery with a range of 500 miles that can last about 1,000 charges and could potentially power the EV over 500,000 miles.

With the potential to deliver 500 to 700 miles of charge in 10 to 20 minutes, and with durability for 1,000 recharges, these batteries could greatly enhance the practicality and appeal of EVs.

Li-sulfur batteries

Li-sulfur batteries, with sulfur cathodes, are more efficient than Li-ion batteries with cobalt and nickel anodes and cathodes. Li-sulfur batteries that promise longer ranges with similar weights could be commercially available by 2028.[1] [2] [3]

Li–metal batteries

A 2021 article on the GreenCars website[4] details promising Li-metal batteries. Li-metal batteries offer higher energy density than Li-ion, which means longer ranges and faster charging times. General Motors is working with SES AI Corp. to manufacture a Li-metal battery that promises 500 to 600 miles of range and an 80% charge in less than 15 minutes. This battery, which could be available by 2028, will be built by GM in the U.S. and used in upcoming models of the Chevy Bolt and Cadillac Lyriq.

Volkswagen is also investing in Li-metal batteries. Partnering with QuantumScape, VW says their ceramic-electrolyte cells can get up to 500 miles on a single charge and are safer, lighter, and quicker to charge than Li-ion batteries.

SK Innovation is developing a new battery with a 500-mile range that can charge from 0% to 80% in ten minutes. They anticipate that their new facility in Georgia will be able to supply batteries for up to 300,000 vehicles a year.

Faster Charging

The U.S. will need to install 182,000 direct current fast charging (DCFC) ports and more than 1 million Level 2 ports by 2030 to serve the estimated 30 million EVs on the roads.

StoreDot is developing an "extreme fast charging" battery with silicon anodes instead of graphite, potentially reducing charge time from 30 minutes to 10 minutes.

The Japan Advanced Institute of Science and Technology is also developing an extreme fast-charging battery, reducing charge time to under 10 minutes. This technology uses a binder material to promote "high conductivity, low impedance, and good stability" when using and charging the battery.

Researchers at Pohang University of Science and Technology are developing a battery anode made of manganese ferrite, which can hold up to 1.5 times the lithium ions previously thought possible, decreasing average charge time from 0% to 80% to under six minutes.[5] [6] [7]

Reduced Battery Weight

With slight changes to design and materials, the new generation of Li-ion batteries promises decreased weight, costs, and charge times.[8] [9] Li-ion batteries have an energy density of 200 to 325 Wh/kg. Many solid-state battery manufacturers are confident they can increase this density from 30% to 50%. This could reduce the weight of an EV battery from 800 pounds average to 550 to 600 pounds and increase its range.[10]

Amprius Technologies plans to deliver batteries that are about half the weight and volume of current Li-ion batteries[11] using an anode with silicon nanowires to decrease EV battery weight and increase range. Nanowire technology could give their batteries an "unprecedented energy density of 500 Wh/kg."

Reduced Battery Costs

Moving away from cobalt and manganese, and toward less expensive and more abundant materials, could reduce battery costs by 50%. These improved battery costs could make EVs less expensive than comparable ICE vehicles by 2027.

Battery improvements coming soon include:

- **Li-iron phosphate** batteries dominant in China are making their way to Europe and the U.S. They are less expensive than traditional Li-ion batteries due to the relative abundance of iron and phosphate compared with nickel and cobalt.
- **Sodium-ion** batteries developed at the Pacific Northwest National Lab will provide an economical alternative to Li-ion with similar energy densities. Commercially scalable sodium-ion batteries will be cheaper than current EV batteries because sodium is a much more abundant resource.[12]
- **Li-silicon** battery anodes and cathodes could rapidly decrease charge time.
- **Li-sulfur** batteries could be cheaper than Li-ion batteries because sulfur is a more available resource than the cobalt or nickel used in Li-ion batteries.

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[1] 7 New Battery Technologies to Watch. BuiltIn. May 6, 2024.
[2] Next Gen EV Batteries Will Deliver 500-Mile Range. GreenCars. Nov. 18, 2021.
[3] New Toyota electric vehicle batteries to offer 900-plus miles of range. FleetNews. June 13, 2023.
[4] Next Gen EV Batteries Will Deliver 500-Mile Range. GreenCars. Nov. 18, 2021.
[5] The future of EV charging: revolutionary developments are closer than you think. Avnet; October 24, 2023.
[6] Researchers from Korea's IBS suggest quantum charging could cut EV charge time. Batteries News. March 21, 2022.
[7] EV battery material breakthrough could cut charging times to 6 minutes. Freethink. Sept. 8, 2023.
[8] Can solid-state batteries help EVs shed weight? *Automotive World*. Aug. 1, 2023.
[9] What's Happening in EV Battery Technology. Driivz. Nov. 2, 2023
[10] The Future of Lithium-ion Battery Technology: Chemistries, Comparisons, and the Close Prospects. Polarium. May 2024.
[11] SiMaxxTM Enables Superior Energy Density for High-Performance Applications. Amprius. Undated.
[12] Longer Lasting Sodium-Ion Batteries on the Horizon. Pacific Northwest National Laboratory. July 13, 2022.

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