



## Battery makers expand silicon anode production

Published date: [29 January 2021](#)

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Battery materials developers are increasing production of silicon anodes to substitute the graphite anodes in lithium-ion batteries, as they look to address the demand for batteries with higher energy density.

Demand from automotive manufacturers and governments to extend the driving range of electric vehicles (EVs) to encourage widespread adoption is prompting battery producers to look for ways to increase the length of time batteries can run between charges. And technological development of smart electronic devices is creating further demand for batteries with larger capacity.

US-based Enovix expects to start production of lithium batteries with silicon anodes during the third quarter of this year. It has begun installing equipment at its newly-constructed facility in California and will start equipment qualification within the next few months. Enovix has battery development agreements with a number of mobile device companies.

Enovix's 3D cell design uses silicon as the only active lithium cycling material in the anode, replacing graphite, and increases energy capacity by 30pc. The production process is designed to use much of the same manufacturing process as conventional lithium-ion batteries. It includes the same electrode fabrication process and the majority of packaging and formation. The company has developed production tools that are drop-in replacements for the tools in conventional lithium-ion battery cell assembly.

US-based Sila Nanotechnologies has raised an investment of \$590mn to finance the construction of a new 100GWh plant in North America to produce silicon-based anode material to serve smartphone and automotive customers. That follows a recent investment of \$10mn from the Advanced Research Projects Agency at the US energy department. The company plans to start production at the plant in 2024. It has partnerships with automakers BMW and Daimler and battery producer ATL.

Like Enovix, Sila has designed its material as a drop-in replacement for graphite in lithium-ion factories, enabling battery producers to increase the energy density of their products without having to change the manufacturing process or equipment. The silicon anode increases battery energy density by more than 20pc and enables fast charging.

In China, Gotion High-Tech said it has developed a new lithium-ion phosphate (LFP) battery cell that uses a silicon anode to create a high energy density of 210 Wh/kg. LFP batteries typically have an energy density up to around 160 Wh/kg, while nickel manganese cobalt (NMC) batteries have an energy density of 150-220 Wh/kg.

China Carbon Graphite Group is responding to the graphite substitution trend by developing a new silicon graphene nanocomposite product for lithium-ion batteries. The new product will replace graphite anode material to enhance the performance of EV and mobile device

batteries. The silicon-based battery anode market is expected to have a high compound annual growth rate in the coming years, the company said.

Israel-based StoreDot, which is developing fast-charging batteries, is advancing the commercialisation of non-graphite anode batteries. It has produced the first batch of sample cells for potential customers to demonstrate the replacement of graphite with metalloid nanomaterials. EVE Energy, StoreDot's strategic partner in China, produced the cells. StoreDot's batteries are designed to be produced on EVE Energy's existing lithium-ion production lines, showing they can be produced without having to adjust equipment.

StoreDot plans to launch its second-generation prototype battery for EVs later this year with a silicon-based anode, shifting from the use of germanium in the first generation. The company has turned its focus to EVs from mobile devices as it has received investments from companies including BP and Daimler.

By Nicole Willing

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