Toyota fastcharges its solid-state battery plans; may spawn 2 BEV ranges

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Written by **Anil Sasi** Follow
New Delhi | January 28, 2024 03:26 IST

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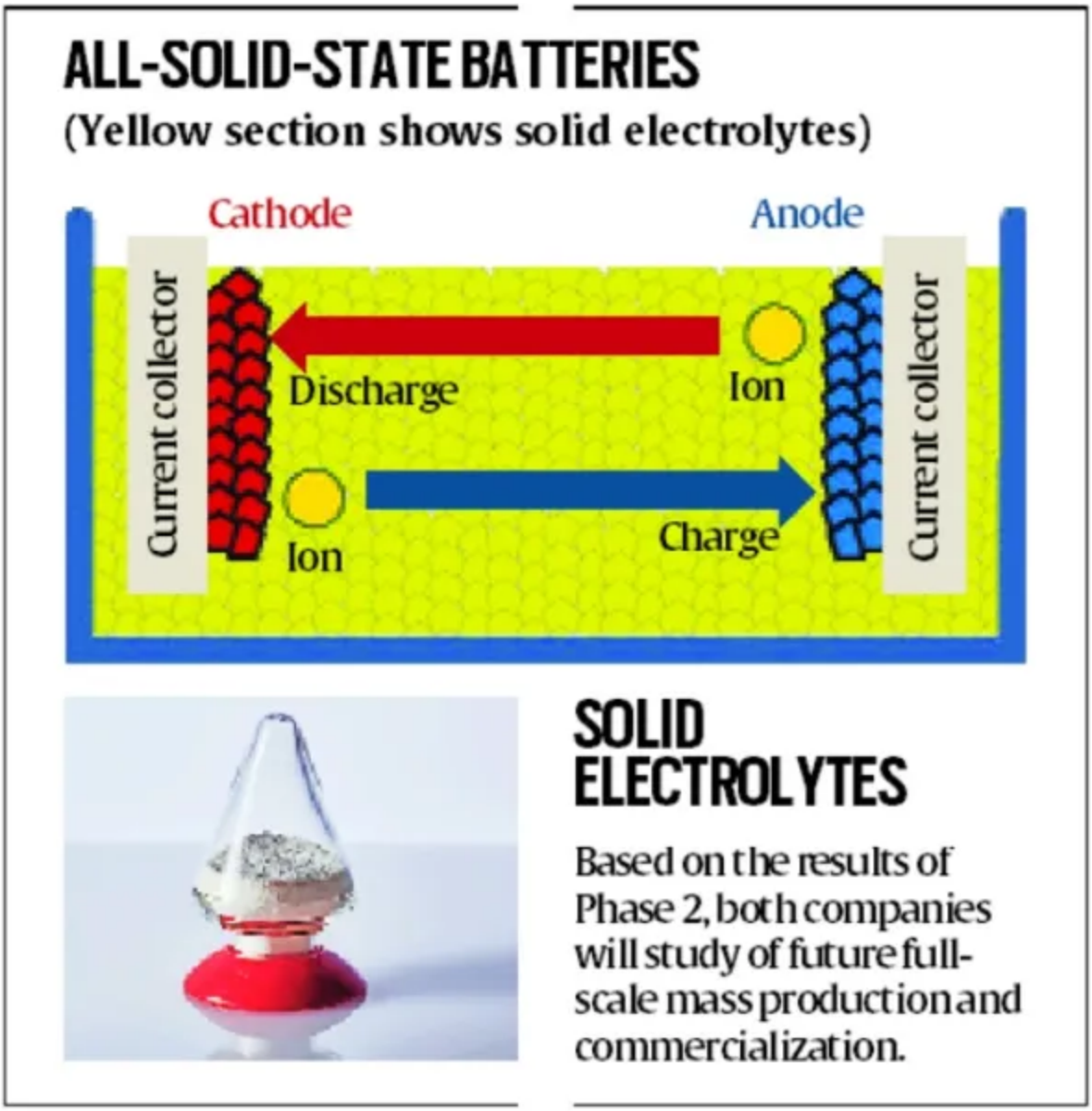
Japan's Toyota Motor Corp, a late entrant into the battery electric vehicle race, is aiming to roll out next-generation solid-state batteries over the next three years, marking a milestone in the global race to commercialise this breakthrough technology that promises to double vehicle range and drastically lower charging time.

In the due course, the Japanese carmaker could potentially have two sets of battery electric vehicles or BEVs on offer across markets, including India – one range with existing lithium-ion (li-ion) batteries and a second range with its new and pricier solid state batteries, a senior company executive at Toyota's joint venture in India indicated.

Toyota, the world's largest carmaker by vehicles sold, had announced a "breakthrough" in solid state battery materials late last year and had said it plans to

mass-produce solid-state batteries by 2027 or 2028. Solid-state batteries are seen as a major improvement in battery tech, countering concerns such as extended charging time and the risk of catching fire associated with traditional Li-ion batteries that have a liquid electrolyte.



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Other companies too are making progress on alternatives to Li-ion batteries. Chinese battery maker CATL revealed in end-2023 it was preparing to mass-produce its semi-solid batteries, while South Korea's Samsung SDI has completed a fully automated pilot line for solid-state batteries. Germany's Volkswagen, whose investment in American startup QuantumScape has been dogged by delays, was

reported by Reuters as having held talks with France's Blue Solutions, which already produces solid-state batteries for Daimler electric buses.

Toyota had, in October, announced a partnership with Tokyo-based petroleum company Idemitsu Kosan to jointly produce a solid-state battery material called sulphide solid electrolyte. This collaboration focuses on sulphide solid electrolytes, which are seen as a promising material to achieve high capacity and output for BEVs. Sulphide solid electrolytes are characterised by softness and adhesiveness to other materials, which is suitable for battery mass production.

The collaboration is focussed on mass-production of new materials and establishing a supply chain for solid electrolytes, which hold the key to the commercialisation of solid-state batteries and developing them as an option beyond liquid batteries, according to Koji Sato, President and Chief Executive Officer, Toyota Motor Corporation.

An advantage of solid-state batteries is that the electrolyte is solid. This allows ions, which convey electricity, to move faster, thus enabling shorter charging times, increased cruising ranges, and produce higher power output. Solid-state batteries are also characterised by being highly stable because they are resistant to changes in temperature and can robustly endure high temperatures and high voltages.

A longstanding technical issue in solid state battery development has been that repeatedly charging and discharging the battery causes cracks between the cathodes and anodes and the solid electrolytes, degrading battery performance.

Idemitsu was one of the first companies to conduct the development of elemental technologies for solid-state batteries. One such elemental technology is a highly flexible, adhesive, and crack-resistant solid electrolyte. Through repeated trial and error and by combining the material technologies of both companies, the venture has been able to develop a crack-resistant material that demonstrates high performance.

By combining this Idemitsu new solid electrolyte with the Toyota Group's cathode and anode materials and battery technologies, the venture is betting on achieving both performance and durability in solid-state batteries. The key theme going forward is mass production, with the two companies together addressing the quality and cost aspects of solid electrolytes.

But producing solid-state batteries in large volumes is costly and difficult, with Goldman Sachs warning of "a relatively tough path towards scaling up over the

coming decade". Problems include the extreme sensitivity of the batteries to moisture and oxygen, as well as the mechanical pressure needed to hold them together to prevent the formation of dendrites, the metal filaments that can cause short circuits.

First uploaded on: 28-01-2024 at 03:26 IST

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