A spreadable interlayer could make solid state batteries more stable

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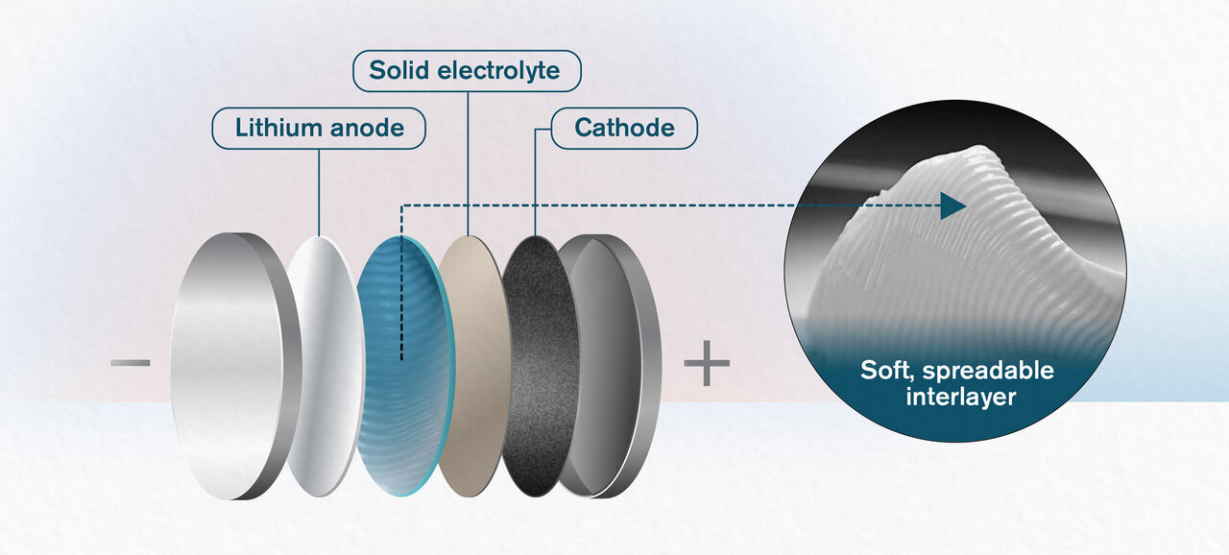

Solid state batteries are of great interest to the electric vehicle industry. Scientists at Chalmers University of Technology, Sweden, and Xi'an Jiaotong University, China now present a new way of taking this promising concept closer to large-scale application. An interlayer, made of a spreadable, 'butter-like' material helps improve the current density tenfold, while also increasing performance and safety. Credit: Yen Strandqvist/Chalmers University of Technology

Solid-state batteries are of great interest to the electric vehicle industry. Scientists at Chalmers University of Technology, Sweden, and Xi'an Jiaotong University, China have now presented a new way of taking this promising concept closer to large-scale commercial application. An

interlayer made of a spreadable, 'butter-like' material improves the current density ten-fold, while also increasing performance and safety.

"This interlayer makes the battery cell significantly more stable, and therefore able to withstand much higher current density. What is also important is that it is very easy to apply the soft mass onto the lithium metal anode in the battery—like spreading butter on a sandwich," says researcher Shizhao Xiong at the Department of Physics at Chalmers.

Alongside Chalmers Professor Aleksandar Matic and Professor Song's research group in Xi'an, Shizhao Xiong has been working for a long time on crafting a suitable interlayer to stabilize the interface for solid-state batteries. The new results were recently presented in the prestigious scientific journal *Advanced Functional Materials*

solid-state batteries could revolutionize electric transport. Unlike today's lithium-ion batteries, solid-state batteries have a solid electrolyte and therefore contain no environmentally harmful or flammable liquids.

A solid-state battery can be likened to a dry sandwich. A layer of the metal lithium acts as a slice of bread, and a ceramic substance is laid on top like a filling. This hard substance is the solid electrolyte of the battery, which transports lithium ions between the electrodes of the battery. But the 'sandwich' is so dry, it is difficult to keep it together—and there are also problems caused by the compatibility between the 'bread' and the 'topping." Many researchers around the world are working to develop suitable resolutions to address this problem.

The material which the researchers in Gothenburg and Xi'an are now working with is a soft, spreadable substance made of nanoparticles of the ceramic electrolyte LAGP mixed with an ionic liquid. The liquid encapsulates the LAGP particles and makes the interlayer soft and

protective. The material fulfills several functions and can be applied easily.

Although solid-state batteries have high potential, there is as yet no established way of making them sufficiently stable, especially at high current densities, when much energy is extracted from a battery cell very quickly in fast charge or discharge conditions. The Chalmers researchers see great potential in the development of this new interlayer.

"This is an important step on the road to being able to manufacture large-scale, cost-effective, safe and environmentally friendly batteries that deliver high capacity and can be charged and discharged at a high rate," says Aleksandar Matic, professor at the Department of Physics at Chalmers, who predicts that solid-state batteries will be on the market within five years.

More information: Shizhao Xiong et al, Design of a Multifunctional Interlayer for NASCION-Based Solid-State Li Metal Batteries, *Advanced Functional Materials* (2020). DOI: 10.1002/adfm.202001444

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