

# Technical parameters of lithium metal solid-state battery

What are lithium-metal solid-state batteries?

Lithium-metal solid-state batteries (LiMSSBs) are currently one of the most promising next-generation energy-storage strategies to enable high energy-density batteries while combating the safety challenges associated with Li metal and liquid electrolytes.

How do mechanical parameters relate to solid-state batteries?

Correspondingly, mechanical parameters describe these mechanical processes and properties from different perspectives, which must be carefully described and distinguished in the context of solid-state batteries.

What are the mechanical properties of lithium metal in a solid-state battery?

With this in mind, the most important mechanical property of lithium metal in a solid-state battery setup would be the continual deformation under persistent compression loads, which is called "creep." Creep plays a crucial role when forming intimate contact between lithium and the SSE layer, affecting the critical current density.

Why are lithium metal batteries becoming a solid-state electrolyte?

1. Introduction The growing demand for advanced energy storage systems, emphasizing high safety and energy density, has driven the evolution of lithium metal batteries (LMBs) from liquid-based electrolytes to solid-state electrolytes (SSEs) in recent years.

Are all-solid-state lithium metal batteries safe?

The pursuit of high specific energy and high safety has promoted the transformation of lithium metal batteries from liquid to solid-state systems. In addition to high reactivity and mobile interface, all-solid-state lithium metal batteries (ASSLMBs) still faces severe inhomogeneity in mechanical and electrochemical properties.

What properties are needed to develop high-performance solid-state lithium metal batteries?

Several typical properties are needed to meet the demand for developing high-performance solid-state lithium metal batteries. First, high ionic conductivity ( $>10^{-4}$  S/cm) is required to ensure favorable electrochemical performance.

Lithium phosphorus oxynitride (LiPON) is commonly used as a solid-electrolyte for being less sensitive to air and the stability of its solid-electrolyte interface (SEI) with metal lithium. On another hand, the lithium cobalt oxide cathode is widely used for battery applications mostly for its high specific capacity, low self-discharge, and excellent life cycle.

High-energy-density and safe energy storage devices are an urged need for the continuous development of the economy and society. 1-4 Lithium (Li) metal with the ultrahigh theoretical specific capacity (3860 mAh g ...

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Lithium metal batteries (LMBs), with their ultralow reduction potential and high theoretical capacity, are widely regarded as the most promising technical pathway for ...

This review systematically introduces the mechanical parameters relevant to solid-state lithium batteries and discusses their corresponding characterization methods.

A cross-section schematic of the battery model (left) and a diagram of the Li<sup>+</sup> transport in the solid electrolyte (right). Images by Lizhu Tong and taken from his COMSOL ...

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The NaS battery was followed in the 1970s by the sodium-metal halide battery (NaMH: e.g., sodium-nickel chloride), also known as the ZEBRA battery (Zeolite ... challenges that developers are confronting in the transition from LIBs to solid-state lithium batteries would also have to be addressed for the Na- based systems. In many ways, SSSB ...

Abstract Garnet-type solid-state lithium batteries (SSLBs) possess excellent potential owing to their safety and high energy density. ... Compositional Engineering of Lithium Metal Anode for High-Performance Garnet-Type Solid-State Lithium Battery. Wenhan Kong, Wenhan Kong. School of Chemistry and Chemical Engineering, South China University of ...

Battery lifetime prediction is a promising direction for the development of next-generation smart energy storage systems. However, complicated degradation ...

in all-solid-state lithium battery Changhong Wang, 1, 23 Tao Deng, Xiulin Fan,<sup>4</sup> Matthew Zheng, ... a lithium metal anode is required in solid-state batteries because of its high theoretical capacity ... several overlooked technical parameters, including the areal capacity of Li metal, SSE thickness, and porosity, are numer- ...

In solid-state batteries, the imposed strain induced by volume changes in a LiCoO<sub>2</sub> cathode (1.9%) and the absolute volume change in a Li metal anode may lead to cracking in sulfide-based SEs and possible battery safety issues (Fig. 16). At present, there is little research on the mechanical stability of these sulfide-based ISEs and their potential use in practical ...

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