Electro-chemo-mechanics of anode-free solid-state batteries

How are anode-free batteries governed by charge-discharge cycling?
The mechanisms governing charge-discharge cycling of anode-free batteries are largely controlled by electro-chemo-mechanical phenomena at solid-solid interfaces,and there are important mechanistic differences when compared with conventional lithium-excess batteries.

Why are anode-free solid-state batteries important?
Anode-free solid-state batteries can enable high energy densities and the ability to manufacture high-quality interfaces. However,during in situ anode formation,dynamic mechanical stresses influence the initial Li metal plating morphology.

Can anode-free solid-state batteries be manufactured?
The insights gained can be used to guide future efforts to enable anode-free battery manufacturing. Anode-free solid-state batteries can enable high energy densities and the ability to manufacture high-quality interfaces. However, during in situ anode formation, dynamic mechanical stresses influ-ence the initial Li metal plating morphology.

Do anode-free solid-state batteries have high energy density?
Anode-free batteries contain no active material at the negative electrode when manufactured,and this can enable them to have high energy density. This Perspective presents a critical overview of the mechanisms governing the behaviour of anode-free solid-state batteries and provides guidance to improve this type of battery.

Are anode-free SSBs a key to a dynamic evolution of electro-chemo-mechanics?
While the work to date on anode-free SSBs has provided a foundation, owing to the buried nature of the interfaces and the need for stack pressure in many applications, gaining mechanistic insight into the dynamic evolution of electro-chemo-mechanics has proved challenging.

What is lithium-free thin-film battery with in situ plated Li anode?
"Lithium-free" thin-film battery with in situ plated Li anode. J. Electrochem. Soc. 147, 517. P., and Sakamoto, J. (2020). Enabling "lithium-free" manufacturing of pure lithium metal solid-state batteries through in situ plating.

Here, we use operando microscopy to develop a model that describes various regimes during in situ Li metal anode formation, which is critical to the manufacture and operation of anode-free ...

In this talk, I will present recent work from our group in understanding and engineering interfaces in "anode-free" solid-state battery configurations.

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Learn about the electro-chemo-mechanical phenomena and challenges of anode-free solid-state batteries, which have high energy densities for electric vehicles. This Perspective article from ...

This article investigates the electro-chemo-mechanics of Li metal anode formation in solid-state batteries with operando 3D video microscopy. It reveals the influence of ...

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A model is proposed to describe the coupled electro-chemo-mechanics that drive the plating morphology and the electrochemical responses of anode-free cells during in ...