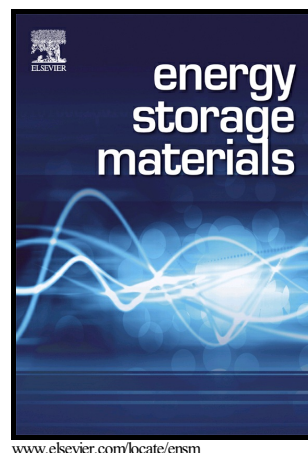


Recent Progress and Perspective on Lithium Metal  
Anode Protection

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## Recent Progress and Perspective on Lithium Metal Anode Protection

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Key words: Li metal anode, Structure design, Interface regulation, Liquid electrolytes, Solid electrolyte

### Abstract

Lithium (Li) metal is treated as ultimate anode for the most promising next-generation high energy density of Lithium-metal batteries (LMBs). However, uncontrolled Li dendrite growth and low Coulombic efficiency during the Li plating/stripping process in the batteries have severely hindered its practical application. In rechargeable batteries, Li dendrite growth not only leads to rapid capacity decay and short lifetime, but also results in severe safety concerns. Although this phenomenon is known for more than 40 years, none of the reported strategies are able to fully solve the problem till now. This review updates the reports and classifies the Li anode protection strategies into four parts: structure design, interface regulation, liquid and solid electrolytes tailoring. To get visual proof of dendrite growth in cells, new technique are utilized to characterize the Li deposition morphology has also been reviewed.

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Lithium (Li) metal is treated as ultimate anode for the most promising next-generation high energy density of Lithium-metal batteries (LMBs). However, uncontrolled Li dendrite growth and low Coulombic efficiency during the Li plating/stripping process in the batteries have severely hindered its practical application. In rechargeable batteries, Li dendrite growth not only leads to rapid capacity decay and short lifetime, but also results in severe safety concerns. Although this phenomenon is known for more than 40 years, none of the reported strategies are able to fully solve the problem till now. This review updates the reports and classifies the Li anode protection strategies into four parts: structure design, interface regulation, liquid and solid electrolytes tailoring. To get visual proof of dendrite growth in cells, new technique are utilized to characterize the Li deposition morphology has also been reviewed.

## 1. Introduction

Lithium (Li) metal is regarded as the ultimate anode for energy-storage systems for its extremely high theoretical specific capacity ( $3860 \text{ mAh g}^{-1}$ ), the lowest redox potential ( $-3.040 \text{ V}$  vs the standard hydrogen electrode) and a low gravimetric density ( $0.534 \text{ g cm}^{-3}$ ).<sup>[1-3]</sup> Rechargeable lithium metal batteries (LMBs) have been extensively studied in the past 40 years and recently

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