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Review article

Quasi-solid-state electrolytes for lithium sulfur batteries: Advances and perspectives

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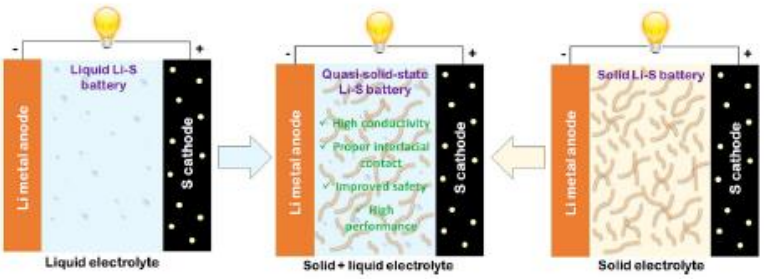
HIGHLIGHTS

- Progresses on quasi-solid-state Li–S batteries (QSSLSBs) are scrutinized.
- Strategies on building high-performance QSSLSBs are discussed.
- Challenges and future directions on the improvement of QSSLSBs are presented.

GRAPHICAL ABSTRACT



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ABSTRACT

Lithium-sulfur (Li–S) batteries are emerging as attractive power sources for light-weight applications (e.g., unmanned aerial and autonomous underwater vehicles) and large electric vehicles (such as trucks and buses) incentivized by their low-cost and high theoretical gravimetric energy density. The replacement of liquid electrolytes with solid-state electrolytes offers a perfect opportunity to improve the safety and energy density of Li–S batteries; however, poor interfacial contact and/or low ionic conductivity at room temperature in the absence of liquid components severely handicap the electrochemical performance of all solid-state Li–S batteries. With the addition of a minimum amount of a liquid plasticizer, a compound which can effectively mitigate the interfacial issues and enhance the ionic transport in both electrolyte and electrode, quasi-solid-state electrolytes (QSSEs) for Li–S batteries, have gained significant attention in recent years. In this review, recent advances and progresses on the development of quasi-solid-state Li–S batteries (QSSLSBs) are scrutinized. Strategies on building high-performance QSSLSBs using polymer-based and inorganic-based QSSEs are intensively discussed on the basis of estimated practical energy density in each cell configuration. Challenges and future directions on the improvement of QSSLSBs are also presented.

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