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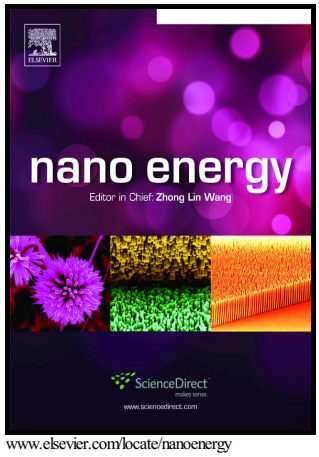


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# Natural Halloysite Nano-Clay Electrolyte for Advanced All-Solid-State Lithium-Sulfur Batteries

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**Abstract**

Solid polymer electrolytes (SPEs) show increasing potential for application in high energy lithium sulfur batteries due to good flexibility and high safety. However, low room temperature ionic conductivity of SPEs has become the main limitation. Herein, a novel SPE film using natural halloysite nano-clay has been fabricated, which exhibits exceptional ionic conductivity of $1.11\times10^{-4}$ S $cm^{-1}$ and lithium ion transference number of 0.40 at 25 $^{o}$C. The mechanism of enhanced lithium ion transport is considered. The oppositely charged halloysite nanotube surfaces separate lithium salt into lithium ions that are absorbed on the negatively charged outer tube silica surface, and anions may be accommodated on the positively charged inner tube aluminol surface. So, an ordered 3D structure for free lithium ion transport is suggested. This potential application of the natural halloysite nano-clay has been demonstrated by an all-solid-state lithium-sulfur battery over a wide temperature range of 25-100 $^{o}$C. These results reveal the possibility of realizing