3D Network Ceramic-Polymer Hybrid All-Solid-State Electrolytes for Lithium Metal Batteries

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Lithium-ion batteries (LIBs) are an efficient energy storage system because of their energy and power density, reliability and cyclability [1]. Unfortunately, the energy density of conventional LIBs will soon reach its limit [2]. In other hand, LIBs use liquid electrolytes are intrinsically unsafe because they are combustible. In contrast, replacing organic liquid electrolyte with solid electrolytes (SE) can potentially address the inherent safety problems in conventional LIBs. High energy density, high safety and long lifespan all-solid-state lithium batteries have recently attracted great interest as potentially safe and stable high-energy storage systems.

Here, a simple, versatile and scalable procedure for fabricating 3D network ceramic-polymer hybrid solid-state electrolytes (3D-CPHSE) composed of ceramic particles uniformly embed in a 3D cross-linked network polymer matrix is described. The ionic conductivity of the 3D-CPHSE reaches 1.04×10^{-3} S cm^{-1} at 80 ℃ and the electrochemical stability window up to 5.0 V (versus Li/Li^{+}). Moreover, it demonstrates superior thermal stability, flexible and excellent dimensional stability at elevated temperature, which can significantly improve the safety of the cell. All these positive effects indicate that the 3D-CPHSE is a promising candidate for advanced lithium metal batteries with high safety.

References:

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