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Influence of Mg2+ on the structure and interface of all-solid-state lithium battery

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The interest in all-solid-state lithium batteries mainly originates from its high safety and energy density compared with conventional Li-ion batteries. Solid polymer electrolytes (SPEs) as an essential component with high durability, long shelf life, high energy density, great flexibility for cell design and low weight are considered as the most promising material for next generation batteries. However, as the most common SPE, poly(ethylene oxide) (PEO) electrolytes have a limited electrochemical window and can react with lithium metal to form a solid electrolyte interphase (SEI), meaning that such SPE is more instable in high-energy-density batteries. Moreover, inhomogeneity at the electrolyte/electrode interface can elicit an irregular lithium plating that leads to dendrite formation, resulting in the cycle life reduction and total cell resistance increase. As a modifying strategy, adding inorganic particles can alter the degree of non-conducting crystalline polymer volume within the electrolyte, promote the dissociation of Li+-TFSI- ion pairs and increase the amount of mobility Li+ ions. Herein, Mg(ClO4)2 is introduced to the electrolyte and a series of SPE-Mgx electrolyte(x ranges from 0.25 to 1) are fabricated to modify the structure of SPE and increase the ionic conductivity. Besides, the additive can also assist in constructing a Li+ conducting SEI at the electrolyte/electrode interface. The formation of SEI layer can be detected during cycling with neutron reflectometry in future measurements.

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