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Thermo and electrochemical-stable composite gel polymer electrolytes derived from core-shell silica nanoparticles and ionic liquid for rechargeable lithium metal batteries

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ABSTRACT

With the aim to overcome the disadvantages of organic liquid electrolytes and all-solid electrolytes, and make better use in the next generation of safe and high energy rechargeable lithium metal batteries. Herein, an effective ionic liquid gel polymer electrolyte is simply prepared using core-shell structured SiO_2 nanoparticles as functional fillers, which is fabricated by controlled reaction conditions, and its structure and purity are characterized. The shell layers of SiO_2-PAA@Li as the lithium ion sources increase both ionic conductivity and lithium transference number of the electrolyte. Especially, it was found to improve thermal stability and increase compatibility between electrolyte and lithium electrode due to the intrinsic characteristics of the silica core structure. More importantly, the morphological analysis of the cycled lithium anode reveals that lithium dendrites growth during cycling can be inhibited by a stable solid electrolyte interphase. For further illustration, the solid-state lithium battery of $LiFePO_4$/Li with this type electrolyte delivers stable charge/discharge profiles and satisfactory performance, determining the important role on the overall electrochemical properties of its unique structural design. These desirable results reveal that the composite gel polymer electrolytes have great potential for safe, stable even high power rechargeable Li metal batteries.

Keywords: Gel polymer electrolyte; Flexible membrane; Core-shell structured; Ionic liquid; Nonflammable; Compatibility.

1. Introduction

Rechargeable lithium-ion batteries（LIBs）with high safety and high energy

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