

PEO 型聚合物电解质在固态电池中的应用

摘要

传统的液体电解质存在各种隐患,研发聚合物固体电解质是现在的研究热点。本文以柔性薄膜的形式制备了掺入陶瓷粉(LATP,即 $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$ 或LLZO,即 $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$)的聚环氧乙烷(PEO)-双三氟甲烷磺酰亚胺锂(LTFSI)或高氯酸锂(LiClO_4)体系的混合固体电解质,并探究电解质隔膜的物理性质和化学性质。考虑到柔性薄膜的离子导电性、机械稳定性和可成形性,LATP或LLZO粉末的最佳组成为整体重量的35.5%。另外制备了磷酸铁锂复合电极,组装了磷酸铁锂复合正极/聚合物电解质膜/锂片结构的全固态电池,进行了充放电循环性能测试。本实验所制备的固态电解质隔膜具有良好的机械性能,可以进行任意弯曲和折叠,热分解温度在250℃以上,满足锂离子电池的日常使用温度范围。组装的复合全固态电池在55℃表现出良好的循环稳定性,并提供不错的放电量,库伦效率在97%以上,充放电平台在3.4V左右

。证明 PEO-LTFSI-35.5%LATP 聚合物固态电解质膜是一种可以应用在全固态锂离子电池中的材料。

关键词：PEO；固体电解质；薄膜

Abstract

Traditional liquid electrolytes have various hidden dangers, and polymer solid electrolytes are expected to replace electrolyte batteries to occupy the market. In this paper, the mixed solid electrolytes of polyethylene oxide (PEO) - lithium bistrifluoromethane sulfonamide (LTFSI) or lithium perchlorate (LiClO₄) doped with ceramic powders (LATP, Li_{1.3}Al_{0.3}Ti_{1.7}(PO₄)₃ or LLZO, Li₇La₃Zr₂O₁₂) were prepared in the form of flexible films, and the physical and chemical properties of the electrolyte diaphragm were investigated. Considering the ionic conductivity, mechanical stability and formability of flexible films, the optimum composition of LATP or LLZO powders is 35.5% of the total weight. In addition, lithium iron phosphate composite electrode was prepared, and all-solid-state batteries with lithium iron phosphate composite cathode/polymer electrolyte membrane/lithium sheet

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