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A mechanically robust porous single ion conducting electrolyte membrane fabricated via self-assembly

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Abstract

A polymer electrolyte with high porosity and good mechanical strength plays a critical role in improving the compatibility between the electrolyte and the electrodes in a battery device by raising the ionic conductivity and enhancing the cyclic performance. Here, we present a facile self-assembly technique to fabricate a single ion conducting polymer electrolyte membrane with appropriate porosity and strong mechanical strength by taking advantage of the poor physical compatibility between the rigid aromatic backbone of the polymer electrolyte and the flexible aliphatic poly(vinylidene fluoride-hexafluoropropylene) used as a binder. The influence of membrane porosity on ionic conductivity and interfacial contacts between the polymer electrolyte and electrodes was investigated. Excellent battery performance at both room temperature and 60 ^{o}C was demonstrated.

1. Introduction

Polymer electrolytes with high ionic conductivity and low interfacial resistance with electrodes can significantly enhance lithium ion battery performance and have been a subject of intense research in recent years.[1-8] An effective strategy to prepare polymer electrolytes with these improved properties is to construct appropriate porosity in the electrolyte membranes. Here, the porosity plays a dual role in improving the battery performance, achieving high ionic conductivity through absorption of a sufficient amount of solvent[9] and reducing interfacial resistance by partially tuning the solid-solid contact between an electrode and the electrolyte into a