交聯型環氧/矽氧烷預聚物製備具有極性末端基之鋰電池固態電解質

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市場及需求:

據報導指出全球鋰離子電池市場規模將從 2020 年的 442 億美元增長到 2025 年的 944 億美元，且預計將以 16.4%的複合年增長率增長。在消費電子產品的日益普及與電能車的迅速發展之下，將推動電池市場持續的增長。鋰電池中的電解質在鋰電池中扮演著影響性能的關鍵角色，尤其是優良固態電解質更是尋求安全及高密度鋰電池所要追求的目標。

技術摘要(含成果):

本發明概念，主要由一系列交聯型環氧/矽氧烷預聚物做為高分子基材，再利用溶膠-凝膠的方式導入製備具有極性末端基之鋰電固態電解質。由於環氧/矽氧烷預聚物具有輕微交聯結構，可以抑制電解質薄膜在充放電過程中受到產生的鋰枝晶破壞。此四種具有不同極性之末端基材料分別為 Si-SH, Si-CN, Si-CF_3, Si-PerF 加入配製好之電解質溶液中，以溶膠-凝膠之方法導入高分子中再去除溶劑得到電解質薄膜，不需額外的製程即可改變鋰離子在高分子基材中的分散性及遷移特性。此一系列電解質之離子導電度(σ)在 80 °C 可達 1.0×10^{-3} S/cm。以 PGSN-SiCN 固態電解質, LiFePO4 做為正極，鋰金屬做為負極，可得到 150 mA h g^{-1} (0.1C) 高容量之充放電效能，並獲得> 97% 之庫侖效率 (coulombic efficiency ; C.E.)。 其中的固態電解質 PGSN 及 PGSN-$SiCF_3$ 之電池容量分別為 122 mA h g^{-1} 與 113 mA h g^{-1} 。

優勢:

1. **具有輕微交聯結構，可以抑制電解質薄膜在充放電過程中受到產生的鋰枝晶破壞。**
2. **不需額外的製程即可改變鋰離子在高分子基材中的分散性及遷移特性。**

競爭產品:

無

專利現況:

無

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Slightly crosslinked epoxy/siloxane precursor with the addition of alkoxysilanes as solid-state electrolytes for lithium ion batteries

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Market Needs:

According to business reports, the global market of lithium-ion battery will grow from US$44.2 billion in 2020 to US$94.4 billion in 2025. The increasing popularity of consumer electronics and the rapid development of electric vehicles will promote the growth of the battery market. Among the materials in lithium ion batteries, electrolytes play a key role in affecting the performance during the charge/discharge process. In addition, the development of solid electrolyte is a strategy for manufacturing a safer and high energy density battery in the future.

Our Technology:

In this invention, a series of crosslinked materials which were prepared by the mixture of epoxy/siloxane precursor and polar end group alkoxysilane compounds. They are evaluated as solid-state polymer electrolytes (SPEs) in lithium ion batteries. Owing to the crosslinking network in the polymer matrix, the lithium dendrite will be blocked during the charge/discharge process. There are four alkoxysilanes with different polar end group for further modification of polymers. Among the electrolytes, PG-SiCN with -CN end group in the matrix behaved a well ionic conductivity (σ) of 1.0×10^{-3} S/cm at 80 ^{o}C. A 150 mA h g^{-1} (at 0.1C) of specific capacity (with a coulombic efficiency; C.E. of 97%) was achieved by a half cell of $LiFePO_4$/PG-SiCN/Li. The other batteries were also evaluated as 122 mA h g^{-1} and 113 mA h g^{-1} when the electrolytes were, PGSN and PG-$SiCF_3$, respectively.

Strength:

1、 The crosslinking network in matrix will restricted the damage of lithium dendrite during the charge/discharge process.
2、 The addition of polar end group in polymer matrix will assist lithium salt well dispersed.

Competing Products:

None

Intellectual Properties:

None

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