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Polymers/zeolite nanocomposite membranes with enhanced thermal and electrochemical performances for lithium-ion batteries

Jiawen Zhang[a], Yakang Xiang[a], Muhammad Imran Jamil[a], Jianguo Lu[b], Qinghua Zhang[a,*], Xiaoli Zhan[a], Fengqiu Chen[a]

[a]*Zhejiang Provincial Key Laboratory of Advanced Chemical Engineering Manufacture Technology. College of Chemical and Biological Engineering, Zhejiang University, Hangzhou 310027, PR China*

[b]*State Key Laboratory of Silicon Materials, School of Materials Science and Engineering, Zhejiang University, Hangzhou, 310027, PR China*

***Corresponding Author**: E-mail: qhzhang@zju.edu.cn. Tel: +86-571-8795-3382. Fax: +86-571-8795-1227.

Abstract

The improvement of ionic conductivity, thermal property, as well as cycle performance, is key to promoting the development of lithium-ion batteries (LIBs). Herein, a nanocomposite separator is prepared by electrospinning and subsequent thermal cross-linking method. The membrane exhibits a highly interconnected macro-porous structure. ZSM-5 molecular sieves are firmly attached to the membrane through chemical bonds. Molecular sieves with special channel structures and strong Lewis acidity are proposed to contribute to the disassociation of lithium salt and the transportation of lithium ion. The three-dimensional cross-linked membrane integrates advantages of ZSM-5, copolymers and polyvinylidenefluoride (PVDF), exhibiting enhanced electrolyte uptake, thermal stability and ionic conductivity. In addition, the cells with nanocomposite membranes possess better cycling performance and improved C-rate capability compared with those cells with polypropylene (PP) separators. The as-prepared nanocomposite separator is promising as a new kind of separator for advanced LIBs with enhanced electrochemical performance.

Graphical abstract