

# Preparation and performance of nanoparticles modified solid-state polymer lithium battery

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Among various kinds of SPEs, PEO is the most commonly used polymer matrix due to its ability to solvate a wide variety of salts through interaction of its ether oxygens with cations.<sup>[1]</sup> However, PEO-based SPEs have not been widely used in commercial lithium-ion batteries ascribe to their low conductivities ( $10^{-6}$ - $10^{-8}$  S/cm) at room temperature and poor electrochemical stability<sup>[2]</sup>. Dispersing ceramic particles in polymer matrix is an effective solution to increase the ionic conductivity of SPEs, meanwhile improving electrochemical stability and mechanical strength. Ceramic particles fillers is believed to hinder the polymer crystallization.<sup>[3]</sup>

We develop a nanoparticles modified solid-state polymer electrolyte by the solution casting method. Nano  $\text{Al}_2\text{O}_3$  particles are well dispersed in a polymer-Li salt matrix to synthesize a polyethylene oxide (PEO)-lithium bis(trifluoromethylsulphonyl)imide (LiTFSI)- $\text{Al}_2\text{O}_3$  solid electrolyte membrane. The structure and morphology of the solid electrolyte were characterized by X-Ray diffraction (XRD) and scanning electron microscopy (SEM). The results show that nano  $\text{Al}_2\text{O}_3$  is homogeneously distributed in PEO(LiTFSI). The ionic conductivity is  $2.43 \times 10^{-4}$  S/cm at  $80^\circ\text{C}$ . The electrochemical window is 5.35 V. Cooperated with  $\text{LiFePO}_4$  cathode, the solid state lithium metal batteries have a good specific capacity of 150 mAh/g at  $80^\circ\text{C}$ .

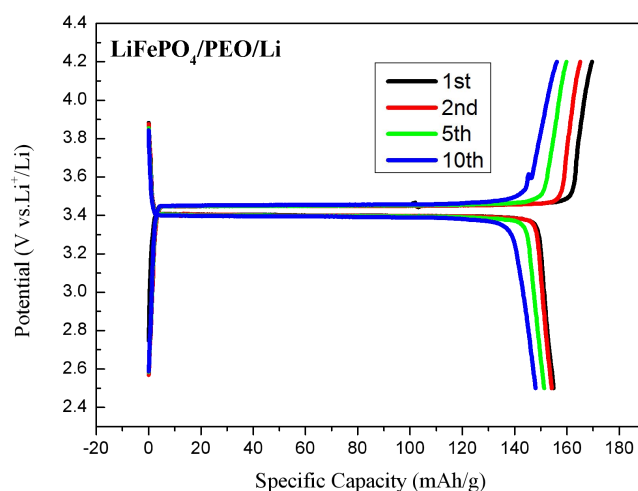


Figure1  $\text{LiFePO}_4/\text{PEO-LiTFSI-Al}_2\text{O}_3/\text{Li}$  coin cell charge-discharge curves at 0.1C at  $80^\circ\text{C}$

## References:

- [1] Thokchom Joykumar S, Chen Christina, Abraham K M. Solid State Ionics. 176 (2005) 1887-1893.
- [2] J.G. Kim, B. Son, S. Mukherjee, N. Schuppert, J Power sources. 282 (2015) 299-322.
- [3] Y.R. Zhao, C. Wu, X.X. Xu, J Power sources. 301 (2016) 47-53.