Molecular Rotation Based Hybrid Polymer Electrolyte for All Solid-State Batteries

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The lithium ion battery can be considered as a staple of modern technology considering the number of devices relying on it. However, the conventional lithium ion battery is not able to satisfy those needs due to the use of highly flammable solvents in its electrolyte. Therefore, much research has been conducted on developing a solid-state electrolyte which is thermally and electrochemically stable. Solid polymer electrolytes (SPEs) have received much attention due to the ease of their synthesis and their superior contact with electrodes. However, SPEs do not have the sufficient ionic conductivity required for commercialization. One of the most radical approaches to improve SPEs is through the use of plastic crystals. We believe that the molecular rotation which these materials possess is the key to their conduction mechanism. Therefore, in this work we investigate the benefits of this property by incorporating rotating molecule with polyacrylonitrile to produce a highly ionically conductive free-standing electrolyte membrane. The rotating molecule[1] based electrolyte membrane reaches ionic conductivities of 1.32×10^{-3} S·cm^{-1} at 22°C, is thermally stable up to 123°C, and is electrochemically stable up to 6 V. One of the most important results achieved in this study is the stable cycling of a full pouch cell assembled with $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$ **(**NMC622) as cathode and graphite as anode.

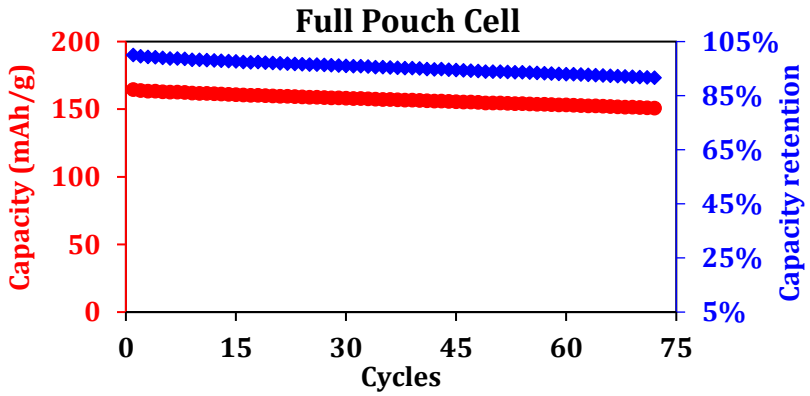

Figure 1. Cycling performance of full pouch cells using $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$ **(**NMC622) as cathode, graphite as anode and GN based electrolyte as solid polymer electrolyte.

References:

[1] K. Geirhos, P. Lunkenheimer, M. Michl, D. Reuter and A. Loidl, , J. Chem. Ph. 143 (2015) 081101