

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

High Aspect Ratio Nanofillers for Solid Polymer Electrolytes¹

LALITHA GANAPATIBHOTLA, JANNA MARANAS, The Pennsylvania State University — In this study, we explore high aspect ratio nanofillers as additives that enhance solid polymer electrolyte (SPE) conductivity at battery working temperatures. SPEs are the key to light-weight and energy-dense lithium ion batteries but suffer from low room temperature ion conductivities. Spherical ceramic fillers are known to improve SPE conductivity and mechanical properties. Our experiments on spherical Al₂O₃ particle filled SPEs indicate highest conductivity enhancement at eutectic composition and temperature. A new mechanism, via stabilization of alternating layers of PEO and highly conducting PEO₆:LiClO₄ tunnels at the filler surface, was suggested by us. More such structures would be stabilized at a filler surface with high aspect ratio. Consistent with this hypothesis, γ -Al₂O₃ nanowhiskers intensify the effect of γ -Al₂O₃ nanoparticles. Increase in conductivity at eutectic composition, and decrease at non-eutectic compositions is more than the nanoparticles. Diameters of the two fillers are similar, but the change in aspect ratio (1 to 100) improves conductivity by a factor of 5. The influence of morphology and PEO dynamics on conductivity enhancement will be presented. All measurements are performed at a series of Li compositions, temperatures and nanowhisker loadings.

¹The authors acknowledge funding from NSF DMR Polymers 0907128

Lalitha Ganapatibhotla
The Pennsylvania State University

Date submitted: 08 Nov 2012

Electronic form version 1.4