MAR16-2016-020476

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

Status of Li-polymer batteries for vehicle applications

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Polymer-based batteries have the potential to revolutionize energy storage because of their ability to allow lithium metal anodes to be used, thereby promising higher energy densities. In addition, there have been vast strides in tuning polymers specific to battery applications, including the use of mixed conductors that provide both electronic and ionic conduction, and multifunctional polymers that serve as, for example, conductors and binders. There has been renewed interest in this topic recently, in the context of solid-state batteries. However, it is still not clear if the properties of presently available solid electrolytes are sufficient to meet the targets for electric vehicle applications. In this talk, we will present a material-to-cell level analysis of solid electrolytes to access the status of presently available materials. Continuum scale models will be used with experiments to understand the underlying processes in the battery and to project energy and power capabilities of solid-state cells based on their material properties. The models use appropriate material properties, where available, and are compared to experimental data to ensure validity. The validated model is then used to estimate the cell-level energy and power capability following the testing protocols specific to electric vehicle application. This analysis helps to identify existing challenges and provides guidelines for research at both material and cell levels for this promising class of next-generation batteries.