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Next generation polymer nanocomposite electrolytes for lithium ion batteries

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There is a growing shift from conventional liquid electrolytes towards solid polymer electrolytes due to the many advantages of polymers including safety, stability and thin film manufacturability. Nanoscale fillers are known to enhance Li ion conductivity as well as improve the mechanical properties of the polymer electrolytes. We will discuss the role of nanoparticles in enhancing ion conductivity including experimental results as well as insights from our continuum-level model and MD simulations. We'll also discuss the use of novel nanoscale fillers including hybrid clay-carbon nanotubes (CNTs) in polymer electrolytes. We show that CNTs grown and insulated within clay layers can work as effective hybrid 3D nanofillers and improve Li ion conductivity of PEO electrolyte by almost two orders of magnitude. Furthermore, the incorporation of only 5% clay-nanotube hybrid particles leads to 160% increase in the tensile strength of the polymer electrolyte. The mechanism of ion conductivity enhancement of the hybrid fillers can be attributed to the high surface density of the 3D hybrid fillers and the strong interaction between the CNT's rich negative electron cloud and positive lithium ions.

Biography

Haleh Ardebili has a BS from Pennsylvania State University, MS from Johns Hopkins University and PhD in Mechanical Engineering from University of Maryland at College Park. She has three years of experience as research scientist at General Electric Global Research Center at Niskayuna, NY. Dr. Ardebili is a co-author of a book titled Encapsulation Technologies for Electronic Applications published by Elsevier. She has postdoctoral research experience with Prof. Ajayan's at Rice University. She's currently an Assistant Professor in the Mechanical Engineering Department at University of Houston. Her research is focused on nanomaterials for energy storage and electronics.

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