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Interfacial origin for performance enhancement and fade of high voltage Li-rich layered oxide cathode in Li-ion batteries

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Enabling the high energy and safe Li-ion batteries requires the use of high capacity and high voltage cathode combined with functional electrolyte. A critical limiting factor for high voltage (> 4.3) operation of Li-rich layered oxide as a promising high voltage and high capacity cathode materials, represented by $x\mathrm{Li_2MnO_3}\cdot(1\text{-}x)\mathrm{LiMO_2}$ (M=Mn,Ni,Co), has been the anodic instability of conventional electrolyte that undergoes a serious oxidative decomposition, causing a rapid performance fade and safety issue. Overcoming the issue and enabling the high energy Li-ion batteries with the cathode thus rely on an electrolyte breakthrough and the stabilization of solid electrolyte interphase (SEI) layer, based on a basic understanding of interfacial reaction behavior and failure mechanisms. We have been evaluating a number of fluorinated carbonates as a high voltage electrolyte component for 4.8V operation of Li-rich layered oxide cathodes. This presentation will summarize our recent results on the SEI stabilization for performance enhancement using fluorinated linear carbonate as a high voltage additive and the interfacial cause for performance fade in conventional electrolyte, in full cells including graphite anode, which were operated at room and elevated temperatures.

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