Understanding Electrode-electrolyte Solution Interactions between TiO$_2$ Nanotube Electrode and Nonaqueous Electrolytes for Sodium-ion Batteries

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Sodium-ion battery technology presents a promising sustainable alternative to the current dominating lithium-ion battery technology due to its low cost associated with its high earth abundance. It has been shown that the interfacial chemistry between anodes and sodium-based or lithium-based electrolytes have markedly different effect even when using the same solvent. It is important to investigate sodium-based electrolytes and to elucidate the mechanisms of electrode and electrolyte interactions. The design and development of next generation electrolytes for sodium-ion batteries is catered towards the improved performance based on evaluation of thermodynamic/transport properties, chemical and electrochemical stability, thermal stability and interfacial chemistry. In this work, we have investigated the electrochemical properties of TiO$_2$ nanotube electrode in various electrolytes containing different solvent mixtures (cyclic, acyclic carbonates) with NaClO$_4$ salt and have found that the interaction between the TiO$_2$NT electrode and the nonaqueous electrolytes plays a critical role in the charging/discharging processes. In addition, we have conducted fundamental studies of the chosen sodium-based electrolytes on their chemical stability, thermal stability and electrochemical stability.

References: