

Chemical Engineering Thesis Defense

Safe Li-Ion Batteries Using Electrode Coated Silicalite Separators For Improved Performance And Cycle Life

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Abstract

Lithium-ion batteries are widely used for high energy storage systems and most of the commercially manufactured lithium-ion batteries use liquid electrolytes and polymeric separators. However, these electrolytes and polymeric separators pose safety issues under high temperatures and in the event of short circuit which may lead to thermal runaway and cause fire. The application of fire-retardant high salt concentrated electrolytes can be used to address the safety issues that arises in the use of liquid electrolytes, but these electrolytes have high viscosity and low wettability when used on polymeric separators which are commercially used in lithium-ion batteries. To address this issue, we have synthesized zeolite powder and prepared separators by coating on the electrode using scalable blade coating method. Zeolite separators have higher wettability and electrolyte uptake compared to polymeric separators such as PP due to their intra-particle micropores. The zeolite separators also have higher porosity compared to PP separators resulting in higher electrolyte uptake and better electrochemical performance of the lithium-ion batteries. Zeolite separators have been prepared using spherical-silicalite and plate-silicalite to analyze the effect of morphology of the particles on the electrochemical performance of the cells. The plate-silicalite separators have higher capacity retention during long-term cycling at low C-rates and better capacity performance at high C-rates compared to spherical-silicalite. Therefore plate-silicalite is very promising for the development of high-performance safe lithium-ion batteries.



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Zoom Link: <https://asu.zoom.us/j/83172914226>