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Withdrawn talk is being given in W4-1 session Transport properties of electrolytes containing esters for high power Li-ion cells (G)

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Li-ion batteries that can charge rapidly without sacrificing lifetime are crucial for the further development of electric vehicles (EVs) and for better customer acceptance. Measuring transport properties such as ionic conductivity and viscosity are simple and effective techniques for screening electrolyte suitability for fast charge applications. The use of low-viscosity esters as co-solvents in traditional carbonate-based electrolytes has been proposed to improve both high-rate and low temperature cycling performance in Li-ion cells. In this work, a novel automated method to measure viscosity is used in combination with ionic conductivity measurements to investigate the transport properties of electrolytes containing different ester co-solvents. Finding methyl acetate (MA) to have the most desirable properties of the esters considered, the impact of MA on viscosity and conductivity when added to electrolytes containing ethylene carbonate (EC), ethyl methyl carbonate (EMC), and dimethyl carbonate (DMC) was studied.
Electrolytes containing solvent blends EC:EMC:MA and EC:DMC:MA, with compositions 30:(70-x):x (wt. %), and LiPF6 concentrations between 0 and 2 mol/kg were considered. Over all conditions, the addition of MA decreases the viscosity of the electrolyte, leading to a corresponding increase in conductivity. Additionally, it was found that these ester-containing electrolytes roughly obey a simple expression for conductivity based on Stokes'Law. A Walden analysis is performed which shows that all electrolytes considered have approximately the same iconicity independent of salt concentration and temperature, leading to the conclusion that the characteristic decrease in conductivity seen at high concentrations of LiPF6 is primarily driven by high viscosity. Conductivity and viscosity data are also compared to a statistical-mechanics model for electrolyte properties, the Advanced Electrolyte Model (AEM). The AEM can calculate many macroscopic transport properties of electrolytes, and it shows excellent agreement with experiment for MA-containing electrolytes. Charge-discharge cycling results for Li-ion cells containing MA in the electrolyte show remarkably improved performance at high charge rates compared to a solely carbonate-based electrolyte.

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