Sebaconitrile-base thermally-safe electrolytes for safety-reinforced lithium-ion batteries

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Lithium-ion batteries safety concern becomes more serious in large-sized and high-capacity application fields such as electric vehicles (EVs) and grid scale energy storage systems, due to the flammability of conventional carbonate-based electrolytes. One promising solution to address the liquid electrolyte-induced safety issues is to replace with nonflammable, thermally-stable electrolytes. Here, we demonstrate a new electrolyte system composed of 1M LiTFSI (lithium *bis*-trifluoromethanesulphonimide) in sebaconitrile (SBN). The SBN is featured with high boiling temperature (~ 375 ^{o}C) (Figure 1a) and negligibly volatility up to a high temperature of 200 ^{o}C compare to the carbonate-based electrolyte showing a dramatic weight loss (Figure 1b), which are expected to enable significant improvements in high-temperature performance of SBN-based electrolytes. Based on the characterization of thermal/electrochemical properties of SBN-based electrolytes, their application to lithium-ion batteries is explored as a function of operating temperature. Notably, the cell incorporating SBN-based electrolytes show stable cycling performance at 80 ^{o}C(Figure 1c, d). This advantageous effect of SBN-based electrolytes on thermal stability of cell, in comparison to conventional carbonate-based liquid electrolytes, is discussed by scrutinizing the variation in AC impedance of cells and ionic conductivity of the electrolytes as a function of temperature (Figure 1e, f).

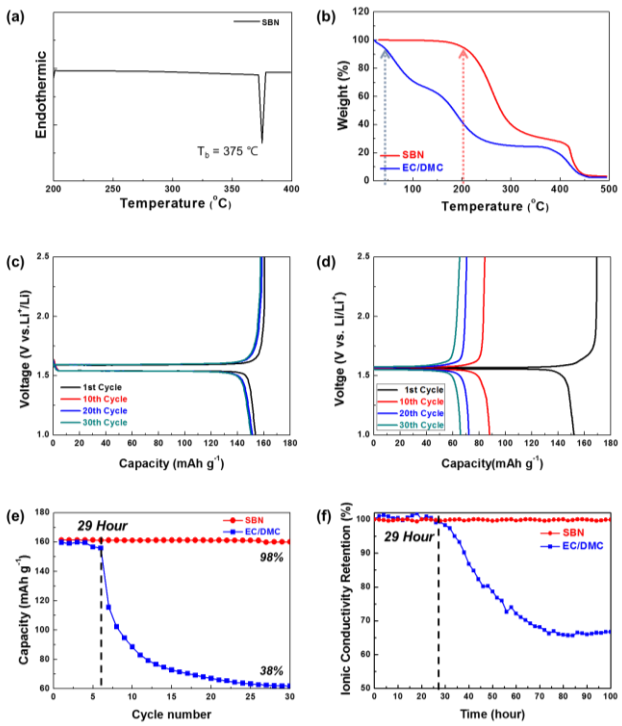

Figure 1. (a,b) Thermal charaterization of (a) DSC profile of SBN (b) Dynamic TGA of SBN and EC/DMC. (c,e) High temperature (at 80 ^{o}C) cycling profiles of (c) SBN and (d) EC/DMC carbonate-based electrolytes (e) and their capacity retention. (f) High temperature (at 80 ^{o}C) ionic conductivity of SBN and EC/DMC-based electrolytes.

References:

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