A New Polymer Binder for Ceramic Coated Separator in Lithium Ion Batteries

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Separator is one of key components in lithium ion batteries. Most commercial separators are made of polyolefin due to its excellent mechanical strength and chemical stability. However, since polyolefin exhibits insufficient thermal stability for large-format LIBs, additional thermal-resistive layer or other separator materials should be considered for this purpose. Most of separator manufacturers prefer to coat ceramic layer upon at least one-side of conventional polyolefin separators as a point of cost. In order to place the ceramic coating layer upon hydrophobic polyolefin separator, a polymer binder and solvent are also carefully selected and well prepared for coating property.

In this work, we try to use co-polyimide (P84, HP Polymer GmbH, Austria, Mw=150,000) as a thermal-resistant polymer binder instead of poly(vinylidene fluoride)(PVDF)-based polymers. The binder solution is prepared by dissolving co-polyimide in dimethylacetamide (DMAc), and then aluminum oxide (Al_2O_3, AES-11, Sumitomo Chemical) is mixed homogeneously in the binder solution. As shown in the Fig 1(b), the ceramics are well closely-packed upon porous polyethylene (PE) separators. The prepared ceramic coated separator shows much enhanced thermal shrinkage and electrolyte wettability comparing to bare PE separator. In addition, regardless of lower permeability property, the ion conductivity and cycle performance is slightly enhanced owing to the hydrophilic property of aluminum oxide.

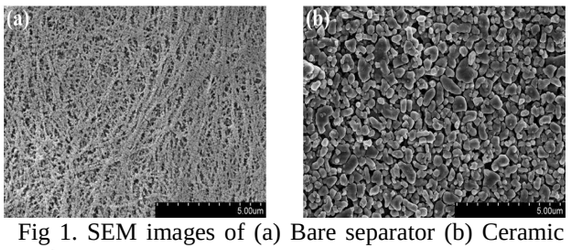

Fig 1. SEM images of (a) Bare separator (b) Ceramic coated separator.

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References

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