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Ultra-High Molecular Weight Polyethylene (UHMWPE) material for lithium battery separators

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Ultra-high molecular weight polyethylene is a kind of resin with excellent physical, chemical, mechanical properties and low price.With high mechanical strength and gel-like structure when melting,UHMWPE lithium ion battery separators show better safety properties than traditional separators. In this work, UHMWPE separators were prepared by thermally induced phase separation (TIPS), using liquid paraffin (LP) as diluent. Specified UHMWPE resin for LiB separators with 1.2 million viscosity molecular weight in average was produced by Shanghai Research Institute of Chemical Industry and used as raw material.The UHMWPE resin was dissolved by LP under heat and shear of a twin-screw extruder, then processed to be film. Raw films were cooled through a series of casting rolls and followed with solid-liquid phase separation, where paraffin was extracted from the film by dichloromethane. The film was then drawn to ideal thickness and tested.The preparation process was optimized by Uniform Design, where permeability, tensile strength, puncture intensity and heat shrinkage was considered as key characteristic for the separators.The results were analyzed via DPS (Data Processing System) software by quadratic polynomial regression method. The simulation result show that ideal experiment condition is the extrusion temperature at 225°c, twin-screw speed at 36rpm, solution concentration at 24% and cooling temperature at 55°c. Verification test was then taken place and the results showed that the air permeability of the separator increased by 53% to 820 s/100ml ,the tensile strength increased by 21% to 173 Mpa,puncture intensity increased by 11% to 515 g/20μm, the heat shrinkage decreased by 57% to 1.2%.

Biography

Xinwei Wang has completed his PhD at 2007 from Donghua University. He is now the Vice Chief Engineer of Technology and Research Center and member of Technical and Economic Committee in Shanghai Research Institue of Chemical Industry. He has been rewarded 2017 Shanghai Outstanding Technology Leader, 2017 Houdebang Chemical Industry Award, First Prize of Shanghai Technological Invention 2016, Shanghai Youth Rising-star Award. He has published more than 20 research papers and 10 patents, which lead to more than 3 billion dollar economic benefits in downstream industries.

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