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Nano SiO_2 particle coating of separators for lithium ion battery

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With the search for a solution as alternative propulsion system, lithium-ion batteries is considered as one of the alternative power sources for Plug-in Hybrid Electric Vehicle (PHEV), particularly with the heightened needs for alternative energy and environment protection. The separator in a battery plays an important role to retain electrolyte, prevent shortage while maintaining high ion permeation, and to perform safe deactivation of the cell under overcharge, abnormal heating or mechanical rupture conditions. Unfortunately, the separator thermal shrinkage and mechanical strength are still serious concerns over the ability to maintain the necessary electrical isolation between electrodes when considered for onboard electric vehicle applications with high power output. Another concern is the formation of dendrites during the charge/discharge cycling of cells which could protrude through the separators and create short circuiting of the electrodes which poses a serious safety concern. We report a novel process on the *in-situ* formation and deposition of SiO_2, as opposed to deposition using commercially available SiO_2 powder suspension in the solution, to form ceramic coating on polypropylene (PP) separators for lithium-ion battery. The *in-situ* formation of SiO_2 nanoparticles with uniform particle size is accomplished through direct hydrolysis of tetraethyl orthosilicate (TEOS), while the deposition of the formed SiO_2 on PP separators was conducted *in-situ* in the same solution containing polyvinylidene fluoride-hexafluoropropylene (PVDF-HFP) as binders and acetone as the solvent. The effects of coating on the surface morphology, tensile strength, contact angles, thermal shrinkage of the separators and the cell performances such as Coulombic efficiency were investigated.

Biography

Ben Luan is a Senior Research Officer at the National Research Council Canada. He received his Ph.D. in Materials Science and Engineering, specialized in battery studies. His research in the past 25 years has focused on the surface engineering for industrial applications in the areas of energy storage and conversion devices, orthopaedic implants, automotive and aircraft components, and rapid prototyping. His research resulted in patents and industrial licensing, as well as over 130 publications as journal papers, technical reports, and conference proceedings.

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