ABSTRACT

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Electrospinning nanofibers as separators for lithium-ion batteries.

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Electrospinning was patented for the first time in the United States in 1902 [1]; however, the process was practically forgotten until a few years ago. The renewed interest in the electrospinning is mainly due to the progresses carried out in the field of nanoscience and nanotechnology. Electrospinning has the unique ability to produce nanofibers of different materials in various fibrous assemblies. The relatively high production rate and simplicity of the setup makes electrospinning highly attractive to both academia and industry . Nanofibers produced by electrospinning are able to form a highly porous mesh and their large surface-to-volume ratio improves performance for many applications such as in energy storage, healthcare, biotechnology, environmental engineering, and defense & security [2]. In this talk we report a new type of polymer battery using polycaprolactone (PCL) nanofiber membranes. The porous structure of the PCL nanofiber membrane favors high and rapid uptake of lithium electrolyte so that electrolyte leakage is reduced. These factors make it possible to hold a large quantity of lithium electrolyte in thinner battery packs. The large surface area of the nanofibrous network also enhances ion conductivity, thus polymer batteries comprising nanofiber membranes may improve energy density per weight as compared with conventional polymer batteries. To evaluate the properties of the PCL nanofiber the membranes were soaked with a DMC-DEC 1M $LiPF_6$ electrolyte solution and characterized by electrochemical impedance spectroscopy. Batteries using lithium as the anode and $LiFePO_4$ as the cathode active material have been assembled and tested to evaluate the performance of the membrane when used as a separator in lithium battery. The results showed that PCL nanofiber membranes can assure a good conductivity and are able to sustain high discharge currents.

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[1] Morton W.J., Method of Dispersing Fluids, 691 (1902) US Patent 705.
[2] S. Ramakrishna, K.T. Fujihara, Kazutoshi, Y. W.-E. Teo,T Yong, Z. Ma, R. Ramaseshan, *Materials Today* 9 (2006) 40-50.