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Electrospinning Technology for Novel Energy Conversion & Storage Materials

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Electrospinning has known to be very effective tool for production of versatile one-dimensional (1D) nanostructured materials such as nanofibers, nanorod, and nanotubes and for easily assembly to two-, three-dimensional(2D, 3D) nanostructures such as thin film, membrane, and nonwoven web, etc. We have studied on the electrospinning technology for novel energy storage and conversion materials such as advanced separator, dye sensitized solar cell, supercapacitor, etc. High heat-resistive nanofibrous membrane as a new separator for future lithium ion polymer battery was prepared by electrospinning of PVdF based composite solution. The novel nanofibrous composite nonwovens have tensile strength of above 50 MPa and modulus of above 1.3 GPa. The internal structure of the electrospun composite nanofiber with a diameter of few hundreds nanometer were composed of core-shell nanostructure. And also electrospun TiO₂ nanorod/nanosphere based dye-sensitized solar cells with high efficiency are successfully prepared. Some battery performance will be introduced.

Keywords: Electrospinning, DSSC, Separator with heat resistance

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Production of Functional Colloids and Fibers from Phase Separation During Electrohydrodynamic Process

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Electrohydrodynamics is a good approach to produce uniform-sized colloids and fibers in a continuous process. The dimension can be controlled from tens of nanometers to a few micrometers. The structure of the colloids and nanofibers from electrohydrodynamics has been diversified according to the uses. Especially, core-shell structure and hybridization with functional nanomaterials are fascinating due to their possible uses in drug-delivery systems, multifunctional scaffolds, organic/inorganic hybrids with new functions, and highly sensitive gas- or bio-sensors. This talk will present the structural variations in the colloids and fibers by simply employing phase separation during electrohydrodynamic process and demonstrate their possible applications.

Keywords: Electrospinning, Electrospinning, Phase separation