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Fabrication and characterization of highly nanoporous PLA fibers via electro spinning

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The surface morphology of electrospinning fibers is crucial when considering end-use applications. Electrospinning fibers with high surface area, inter-fiber pores and unique properties have drawn interests in research for potential applications in diverse fields. In this paper, we reported an effective and simple approach to prepare highly porous PLA fibers directly via electrospinning. PLA was dissolved in the solvent mixtures of N, N-dimethylformamide (DMF) and CHCL3 (CF). As the solvent evaporated in combination with high fiber stretching under the electrical force, the concentrated polymer-rich phase solidified into the matrix, whereas the solvent-rich phase eventually transformed into the pores as solvent dried out. The porous structures of the fibrous mats were characterized by field emission scanning electron microscopy to confirm that they could be accurately controlled by tuning vapor pressure of CHCL3 (CF) and N,N-dimethylformamide (DMF) solvent mixtures. The effects of the solvent compositions on the characteristics of as-spun fibers such as pore size and pore distribution were intensively investigated. The viscosity of mixed solvents of CF and DMF with various weight ratios of 10/0, 8/2, 5/5, 2/8 and 0/10 were decreased. The surface morphology of fibers electrospun from DMF alone displayed featureless. With CF increased in the solvent mixture, the pore diameter and pore size distribution both increased. The CF/DMF mixing ratio in PLA solutions was proved to be a key parameter to affect porous structure which was induced by phase separation resulting from rapid evaporation of solvent in electrospinning.

Biography

Na Si is a postgraduate student in College of Textile and Clothing Engineering, Soochow University. Research include in the field of electrospinning, and nanofibers engineering.

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Nanofibers of polymer, produced by electrospinning

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There are several methods to synthesize polymer nanometer fibers. Electrospinning is a versatile method commonly used to manufacture polymer nanofibers. An electrical charge was used by Electrospinning to draw the nano scale fibers from a liquid. When a sufficiently high voltage is applied to a liquid droplet, the body of the liquid becomes charged. The surface tension counteracted by electrostatic repulsion and the droplet is stretched. From the surface, it was erupted at a critical point a stream of liquid. This point of eruption is known as the Taylor cone. The surface tension overcame and caused an electrically charged jet to be ejected. When the jet dries or solidifies, an electrically charged fiber was finally deposited on the grounded collector. The fiber diameter was varied by adjusting the concentration of the polymer solution. Collection of electrospun nanofibers across two parallel plates is a technique useful for creating nanofiber structures because it allows for the collection of linearly oriented individual nanofiber arrays. These arrays can be easily transferred to other substrates or structures. Scanning electron microscopy was used to characterize the size of the nanofibers. Polymer nanofibers exhibit properties that make them a favorable material for the development of tissue engineering scaffolds, filtration devices, sensors, and high strength lightweight materials. It is of importance to have some understanding of the capabilities of this collection method, such as the maximum length of fibers that can be collected across two parallel plates. The effect of different electrospinning parameters on maximum fiber length, average fiber diameter, diameter uniformity, and fiber quality was explored. Experimental results lead to the hypothesis that even longer continuous nanofibers over 50 cm could be collected if the size of the drum collector were increased. Polymer solution concentration, various collectors, distance and applied voltage were all shown to have varying effects on maximum fiber length, fiber diameter, and fiber uniformity. An overview of recent progress in polymer nanofibers prepared by electrospinnning was presented.

Biography

Nay Soe Aung has completed his ME&Tech at the age of 27 years from Moscow State Engineering and Physics Institute. He is an assistant lecturer of Myanmar Science and Technology Research Center.

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