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Development of Electrospun Porous Carbon Fibers from Cellulose/Polyacrylonitrile Blend

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Abstract : Carbon fibers are one of the most demanding materials on earth due to their potential application in energy, high strength materials, and conductive materials. The nanostructure of carbon fibers offers enhanced properties of conductivity due to the larger surface area. The next generation carbon nanofibers demand the porous structure as it offers more surface area. Multiple techniques are used to produce carbon fibers. However, electrospinning followed by carbonization of the polymeric materials is easy to carry process on a laboratory scale. Also, it offers multiple diversity of changing parameters to acquire the desired properties of carbon fibers. Polyacrylonitrile (PAN) is the most used material for the production of carbon fibers due to its promising processing parameters. Also, cellulose is one of the highest yield producers of carbon fibers. However, the electrospinning of cellulosic materials is difficult due to its rigid chain structure. The combination of PAN and cellulose can offer a suitable solution for the production of carbon fibers. Both materials are miscible in the mixed solvent of N, N, Dimethylacetamide and lithium chloride. This study focuses on the production of porous carbon fibers as a function of PAN/Cellulose blend ratio, solution properties, and electrospinning parameters. These single polymer and blend with different ratios were electrospun to give fine fibers. The higher amount of cellulose offered more difficulty in electrospinning of nanofibers. After carbonization, the carbon fibers were studied in terms of their blend ratio, surface area, and texture. Cellulose contents offered the porous structure of carbon fibers. Also, the presence of LiCl contributed to the porous structure of carbon fibers.

Keywords : cellulose, polyacrylonitrile, carbon nanofibers, electrospinning, blend
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