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Carbon Nanofibers with Inter-bonded Fibrous Structure for Supercapacitance Application

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Abstract:

Supercapacitors have extremely high power density and can be charged and discharged quickly and repeatedly for a long time without degradation. Electrospun carbon nanofiber membrane has been shown a great potential as electrode materials attributed to their porous high structure and large specific surface area. However in electrochemistry-associated processes, nonwoven-like fibrous structure often has low charge-transfer efficiency because of the insufficient fiber-fiber interconnection and large contact-resistance. In this work, interconnected carbon nanofibrous membranes were prepared by conventional electrospinning and bicomponent electrospinning to produce polyvinylpyrrolidone (PVP)/polyacrylonitrile (PAN) blend nanofibers and PVP/PAN side-by-side nanofibers, followed by a direct pyrolysis treatment. The inter-fiber connection was highly affected by the PVP/PAN ratio and electrospinning method. The carbon nanofibers prepared from the side-by-side PVP/PAN nanofibers were found to have higher electrochemical capacitance compared to those from the PVP/PAN blend nanofibers. The effects of electrospinning methods on the crystallinity, surface morphology and resistivity of carbon nanofibers were also examined.

Keywords: Electrospinning, Carbon nanofibers, Inter-fiber connections, Supercapacitance.