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Enhancement of electrical conductivity of electrospun polyacrylonitrile fibres using carbon nanomaterials synthesised from polypropylene waste

Abstract

Incorporation of carbon nanomaterials (CNMs) into polymer such as Polyacrylonitrile (PAN) fibres allow electric current to pass through easily. Therefore in this study, bulk quantities of CNMs are synthesised using Chemical Vapor Deposition (CVD) method by manipulating the reaction time and catalyst ratio. Polypropylene wastes are used as the carbon precursor and ferrocene as metal catalyst in the CVD experiment. Addition of 1 wt% synthesised-CNMs into electrospun PAN fibres successfully increased the electrical conductivity by 50%. Addition of CNMs improved the crystallinity of electrospun-PAN/CNMs fibres as proven by XRD analysis. Electrospun PAN/CNMs-A fibres show larger diameter than the diameter of electrospun PAN/CNMs-B. Large bead formations contained densely-packed CNMs-A within the structure of electrospun PAN/CNMs-A fibres hindered their effectiveness to conduct the electricity. On the contrary, PAN/CNMs-B shows remarkable improvement in electrical conductivity when loosely-packed CNMs-B are added to the PAN fibres.

Keywords

Carbon nanomaterials; Chemical vapor deposition; Electrospun PAN/CNMs fibres; Metal to carbon precursor ratio; Polypropylene; Reaction time