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Electrical Properties of Nanocomposite Fibres Based On Cellulose and Graphene Nanoplatelets Prepared Using Ionic Liquids

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Abstract : Graphene, a single layer of carbon atoms in a hexagonal lattice, has recently attracted great attention due to its unique mechanical, thermal and electrical properties. The high aspect ratio and unique surface features of graphene resulted in significant improvements of the nano composites properties. In this study, nano composite fibres made of cellulose and graphene nano platelets were wet spun from solution by using ionic liquid, 1-ethyl-3-methylimidazolium acetate (EMIMAc) as solvent. The effect of graphene loading on the thermal and electrical properties of the nanocomposite fibres was investigated. The nano composite fibres characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) analysis. XRD analysis revealed a cellulose II crystalline structure for regenerated cellulose and the nano composite fibres. SEM images showed a homogenous morphology and round cross section for the nano composite fibres along with well dispersion of graphene nano platelets in regenerated cellulose matrix. The incorporation of graphene into cellulose matrix generated electrical conductivity. At 6 wt. % of graphene, the electrical conductivity was 4.7 × 10-4 S/cm. The nano composite fibres also showed considerable improvements in thermal stability and char yield compared to pure regenerated cellulose fibres. This work provides a facile and environmentally friendly method of preparing nano composite fibres based on cellulose and graphene nano platelets that can find several applications in cellulose-based carbon fibres, conductive fibres, apparel, etc.

Keywords : nanocomposite, graphene nanoplatelets, regenerated cellulose, electrical properties
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