https://doi.org/10.53230/tgm.1310-912X.2024.1001.13

MAGNETIC NANOPARTICLES CONFINED POLYACRYLONITRILE NANOFIBERS

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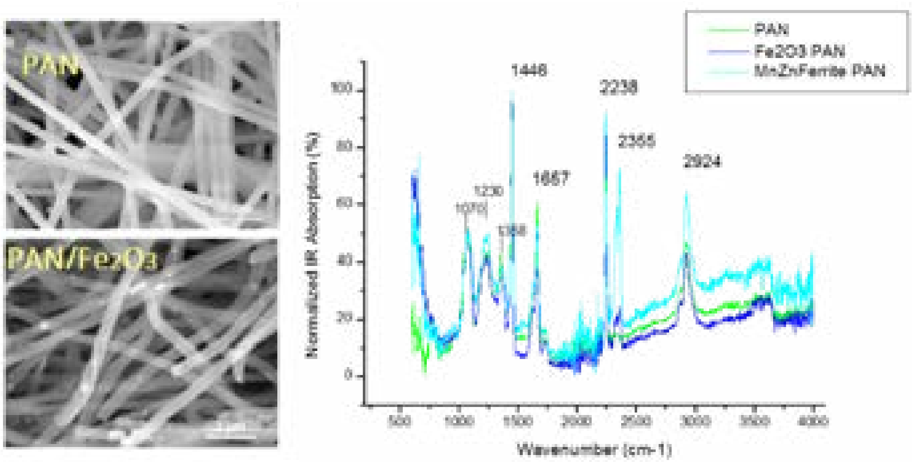

Introduction Electrospinning employs electrical forces to create micro- and nanofibers from polymer solutions[1-3],with the ability to produce diverse forms of polymeric fibrous assemblies.The remarkable specific surface area and high porosity make electrospun nanomaterials highly attractive to ultrasensitive sensor technologies and increase their importance in nanotechnological applications,and i.e.,filtration ,biotechnology ,and environmental engineering.In particular, smart textile products i.e.,medical textiles used in wound dressing, tissue engineering, and drug delivery,protective clothing,energy storage, catalysts, electric double-layer capacitors .In this study, production and advanced experimental characterizations and interfacial interaction of confined and homogenously dispersed magnetic nanoparticles of iron oxide(Fe2O3) and mangan zinc ferrite(MnZnFerrite) in polyacrylonitrile (PAN) matrix as in the nanofiber form are studied in detail [4].

Experimental part Polymer mixtures were electrospun at ambient temperature with driving voltages of 10-15 kV,with a constant distance of ~15 cm between the capillary tip and the collector, and the feed rate was 1 mL/h. Metal oxide nanoparticle(MeONP) contents are prepared as 10% PAN/DMF solution(5% w/w, MeONP /PAN).DMA experiments were performed using Perkin Elmer DMA-8000 between 300 K – 800 K with a heating rate of 5 K min–1 and at 0.5 to 15 Hz. XRD was performed with a Bruker D2Phaser diffractometer(Co Kα, $\lambda = 0.1790$) with an LYNXEYE-2 detector. Morphological characteristics of the produced nanofibers were examined by SEM and integrated energy-dispersive X-ray (EDX) analysis.

Results & Discussion Electrospun nanofibers blended with MeONPs were thermomechanical, morphological, and spectroscopically characterized .By the application of an external magnetic field in the course of dynamic mechanical analysis(DMA) under tension, the storage modulus of the glass transition (Tg) of Fe2O3/PAN rises at the expense of the loss modulus, and a new peak emerges at ~350 K. For the MnZn Ferrite/PAN nanofibers a relatively larger shift in Tg is observed, emphasizing that in comparison to Fe2O3, in MnZnFerrite nanoparticles Mn increses the magnetic response of the material.

HRSEM, XRD, spectroscopic and thermomechanical results enlighten the mechanism of interaction between nanoparticle-polymer matrix through the determination of the morphology, interactions, and the crystallinity of the synthesized fibers with the presence of nanoparticles. SEM imaging and EDX mapping indicate NPs are well dispersed in PAN composite nanofibers with minimum bead formation. MeONPs embedded in the polymer matrix hinder cross-linking throughout the network and enhance the inter-chain interactions. For the Fe2O3-containing PAN, the main peak splits into two peaks under the external magnetic field.

Keywords: *Electrospun nanofibers,magnetic nanoparticles , polyacrylonitrile*

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