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Hybrid Nanostructures of Acrylonitrile Copolymers

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Abstract : Acrylonitrile (AN) copolymers with typical comonomers of vinyl acetate (VAc) or methyl acrylate (MA) exhibit better mechanical behaviors than its homopolymer. To increase processability of conjugated polymer, and to obtain a hybrid nano-structure multi-stepped emulsion polymerization was applied. Such products could be used in, i.e., drug-delivery systems, biosensors, gas-sensors, electronic compounds, etc. Incorporation of a number of flexible comonomers weakens the dipolar interactions among CN and thereby decreases melting point or increases decomposition temperatures of the PAN based copolymers. Hence, it is important to consider the effect of comonomer on the properties of PAN-based copolymers. Acrylonitrile vinylacetate (AN–VAc) copolymers have the significant effect to their thermal behavior and are also of interest as precursors in the production of high strength carbon fibers. AN is copolymerized with one or two comonomers, particularly with vinyl acetate The copolymer of AN and VAc can be used either as a plastic (VAc > 15 wt %) or as microfibers (VAc < 15 wt %). AN provides the copolymer with good processability, electrochemical and thermal stability; VAc provides the mechanical stability. The free radical copolymerization of AN and VAc copolymer and core Shell structure of polyprrole composites,and nanofibers of poly(m-anthranilic acid)/polyacrylonitrile blends were recently studied. Free radical copolymerization of acrylonitrile (AN) – with different comonomers, i.e. acrylates, and styrene was realized using ammonium persulfate (APS) in the presence of a surfactant and in-situ polymerization of conjugated polymers was performed in this reaction medium to obtain core-shell nano particles. Nanofibers of such nanoparticles were obtained by electrospinning. Morphological properties of nanofibers are investigated by scanning electron microscopy (SEM) and atomic force spectroscopy (AFM). Nanofibers are characterized using Fourier Transform Infrared - Attenuated Total Reflectance spectrometer (FTIR-ATR), Nuclear Magnetic Resonance Spectroscopy (1H-NMR), differential scanning calorimeter (DSC), thermal gravimetric analysis (TGA), and Electrochemical Impedance Spectroscopy. The electrochemical Impedance results of the nanofibers were fitted to an equivalent curcuit by modelling (ECM).

Keywords : core shell nanoparticles, nanofibers, ascrylonitile copolymers, hybrid nanostructures
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