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Electrophoretic Deposition of Ultrasonically Synthesized Nanostructured Conducting Poly(o-phenylenediamine)-Co-Poly(1-naphthylamine) Film for Detection of Glucose

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Abstract : The ultrasonic synthesis of nanostructured conducting copolymer is an effective technique to synthesize polymer with desired chemical properties. This tailored nanostructure, shows tremendous improvement in sensitivity and stability to detect a variety of analytes. The present work reports ultrasonically synthesized nanostructured conducting poly(o-phenylenediamine)-co-poly(1-naphthylamine) (POPD-co-PNA). The synthesized material has been characterized using Fourier transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy, transmission electron microscopy, X-ray diffraction and cyclic voltammetry. FTIR spectroscopy confirmed random copolymerization, while UV-visible studies reveal the variation in polaronic states upon copolymerization. High crystallinity was achieved via ultrasonic synthesis which was confirmed by X-ray diffraction, and the controlled morphology of the nanostructures was confirmed by transmission electron microscopy analysis. Cyclic voltammetry shows that POPD-co-PNA has rather high electrochemical activity. This behavior was explained on the basis of variable orientations adopted by the conducting polymer chains. The synthesized material was electrophoretically deposited at onto indium tin oxide coated glass substrate which is used as cathode and parallel platinum plate as the counter electrode. The fabricated bioelectrode was further used for detection of glucose by crosslinking of glucose oxidase in the PODP-co-PNA film. The bioelectrode shows a surface-controlled electrode reaction with the electron transfer coefficient (α) of 0.72, charge transfer rate constant (ks) of 21.77 s^{-1} and diffusion coefficient 7.354×10^{-15} cm^2s^{-1}.

Keywords : conducting, electrophoretic, glucose, poly (o-phenylenediamine), poly (1-naphthylamine), ultrasonic
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