

Characterization of Electrosynthesized Polydihaloanilines

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Abstract

The nucleation and growth mechanism of some homopolymers of aniline (six monomers were studied: 3,5-dichloroaniline, 2,5-dichloroaniline, 2,6-dichloroaniline, 2,3-dichloroaniline, 2,5-dibromoaniline, and 2,6-dibromoaniline), synthesized by potentiostatic methods, was determined with a mathematical model that considers different contributions from current–time transients with a gold-disc electrode. Deconvolution of the transients for the dichlorinated monomers showed IN3Dct and PN3Ddif contributions (where IN3Dct refers to an instantaneous nucleation and three-dimensional growth mechanism under charge-transfer control and PN3Ddif refers to a progressive nucleation and three-dimensional growth mechanism under diffusion control), whereas IN2D and PN3Ddif components and IN2D, IN3Dct, and PN3Ddif components (where IN2D refers to an instantaneous nucleation and two-dimensional growth mechanism) were needed for 2,5-dibromoaniline and 2,6-dibromoaniline, respectively. The percentage of the contribution of the current–time transient to the total charge was worked out for each monomer. The effect of the scan rate on the voltammetric profile during the potentiodynamic electrosynthesis of the polymers was studied too. Curves of the current versus the square root of the potential scan rate were recorded for a selected group of monomers, and the slope was considered an estimation of the diffusion coefficient of the respective monomer. Furthermore, the electrosynthesized polymers were characterized with Fourier transform infrared, ultraviolet–visible, X-ray photoelectron spectroscopy, and scanning electron microscopy. Microanalysis, used to establish the ratio of the atomic percentages of P and N for each polymer synthesized at a constant potential, was performed for doped and undoped polymers. This parameter was a measure of the degree of electrochemical doping. The conductivity of the doped and undoped polymers was also measured. Hence, the systematic characterization of this analogue series of monomers allows, before generalization, an adequate experimental design to prepare polymers with the properties required for their use.

Keywords

Conducting polymers, Electrochemistry, Nucleation.