Electro-Characterization of Polypyrrole Electrosynthesized on a Montmorillonite Host-Matrix, In Aqueous Media Containing Sulphuric Acid as Supporting Electrolyte.

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Abstract: In this paper polypyrrole has been electrosynthesized from an aqueous media containing the pyrrole monomer and sulphuric acid as the supporting electrolyte. The redox properties of polypyrrole on carbon graphite working electrode and on a clay montmorillonite host matrix has also been reported. The results obtained from plots of oxidative and reductive peak currents yield redox efficiencies above 95% for the polypyrrole redox process. The polypyrrole redox process is also shown to be diffusion limited. The reduction in the rate of electrodeposition of polypyrrole on a polyaniline loaded clay montmorillonite host matrix, is a veiled confirmation of intercalation of the polyaniline in montmorillonite matrix.

Keywords: Polypyrrole, Polyaniline, Electrosynthesized, Clay Montmorillonite (bentonite), Cyclic voltammogram, Host matrix

I. Introduction

Polymers have traditionally been considered exclusively as insulators, a property which has allowed their use in the fabrication of various electrical gadgets. During the 1970s, a new class of polymers referred to as electronically conducting polymers, possessing high electronic conductivity in the partially oxidized state was reported by several researchers. The emergence of these electronically conducting polymers resulted in a paradigmatic change in scientific thinking opening up new vistas/frontiers in chemistry, physics and materials science.

Polycryllylene the pioneer conducting polymer was prepared by Shirakawa and coworkers, while its ‘doping’ by the group led by MacDiarmid and Heeger led to improved levels of conductivity. These splendid researches on electronically conducting polymers are found references (1-10) and references therein.

Electronically conducting polymers- polyaniline, polythiophene, and polypyrrole have been the subject of intense research and this has been as a result of their unique properties such as low density, high anisotropy of electrical conduction, versatility in methods of production and non-metallic temperature dependence of conductivity.

Electrochemical and chemical methods have been used to synthesize these polymers. Electrochemical techniques enable controlled synthesis of these compounds in addition to allowing qualitative and quantitative assessment of their redox states.

Conducting polymers tend to be brittle, infusible, and intractable. The presence of conjugated double bonds and at times cross linked covalent bonds, result in strong inter- and intra-molecular interactions.

The application of these polymers in various fields require that, they be stable and easy to process, properties which are strongly dependent on on the processing conditions such as temperature, concentration, and stoichiometry as well as on the type of monomer, oxidant, dopant, and solvent used (1-10).

Electronically conducting polymers find application in the fields of energy storage, electrocatalysis, organic electrochemistry, bioelectrochemistry, photoelectrochemistry, electroanalysis, sensors, electrochromic displays, microsystem technologies, electronic devices, microwave screening and corrosion protection, etc (see references 11-13 and references therein).

In this paper the electrosynthesis and the redox features of polypyrrole electrogenerated from an aqueous media containing sulphuric acid as supporting electrolyte is reported. The working electrodes are bare carbon graphite and clay montmorillonite as a host matrix on carbon graphite electrode. Polypyrrole redox features on a polyaniline loaded montmorillonite host matrix is also reported.