Abstract

Electrochemical synthesis, characterisation and electrochromic properties of polyaniline and some of its derivatives will be discussed in this thesis. In addition, the applications of polyaniline in electrocatalysis and liquid crystal display devices will also be described.

Aniline was polymerised to yield polyaniline by potentiostatic and potential cycling methods. Potentiostatic polymerisation required at least +0.60 V with respect to a Saturated Calomel Electrode (SCE) and in the latter case the potential was cycled between -0.10 V and +0.80 V with respect to the SCE. Polyaniline films prepared from solutions having pH value greater than 3 were insulators, but those prepared in strong acidic media (pH<3) had potential dependent conductivity. These films can be switched reversibly from a conducting state to a non-conducting state by cycling the potential within the range of solvent limits. The background electrolyte had a decisive effect on the conductivity of the material. The change in applied potential of polyaniline resulted in the change in colour as is well known. i.e. polyaniline exhibits electrochromic properties. The colour of the polymer depends on various factors such as potential, pH, type of the background electrolyte etc. Among the various polymers studied, N-alkyl derivatives of polyaniline exhibited intense colours and fast switching times.

Small organic molecules such as methanol and ethanol are adsorbed on to platinum (Pt) electrodes and oxidation products of these molecules usually poison the electrode surface leading to complete suppression of electrode activity. It has been found that Pt electrodes modified by the deposition of a thin layer of polyaniline are resistant to such deactivation, and can be used repeatedly as working electrodes.

Alignment of nematic (7CB) and ferroelectric (CS1013) liquid crystals on rubbed polyaniline films has also been investigated. It was found that polyaniline serves as an excellent template for the alignment of both nematic and ferroelectric liquid crystal molecules. Polyaniline also acts as a conducting surface under the conditions of preparation.