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Conducting Polymer-Based Chemical Sensors

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Abstract

The Polyaniline matrix is synthesized using Galvanostatic method. The synthesized matrix was characterized by using electrochemical technique four probe technique and Scanning Electron Microscopy (SEM). the present work. using conducting polymer for chemical sensing and has focused on the area of Gas and order sensing and has ability to fabricate sensors.

Keywords : Chemical sensor, polyaniline, conductivity and Scanning Electron Microscopy.

Introduction

A chemical sensor is a device that transform chemical information, ranging from the concentration of a specific sample component to total composition analysis into an analytically useful signal. The chemical information mentioned above may originate from a chemical reaction of the analyte or from a physical property of the system investigated [1] Typical chemical sensors consist of two main receptor and transducer. The receptor transforms chemical information into a form of energy which are measured by transducer. the transducer converts this energy into a useful typically electrical, analytical signal. Chemical sensors can be classified according the operating principle of the transducer as shoen in Table 1.

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Table1: Classification of chemical sensors by transducer operating principle

Transducer operating Principle	Measured properties	Source of signal
Electrochemical	Voltammetric	change in current is measured
Electrochemical	potentiometric	charge of electrode potential is measured against reference electrode

A number of other classification scheme can be based on the type of sensitive material (polymeric and inorganic) fabrication technology (screen printed and vapour deposited) field of application (medicine and Environmental) a so on. The synthesis and characterization of electro active polymers have become two of the most important areas of research in polymer and materials science [2]. Amongst conducting polymers, polyaniline (PANI) receives greater attention as a conducting organic material due to its good environmental stability [3-4]. The ability to be formed in aqueous electrolytic solutions [5] PANI is recognized to be an air-stable organic conducting polymer with interesting electrochemical properties. In particular, glucose is of special importance because of its involvement in human metabolic process [6]. Intrinsically conductive polymers (ICPs) have several properties with potential technological applications, including chemical sensors [7] and biosensors [8]. Due to this feature, sensors based on PAni have been constructed and used on devices capable of producing different responses when exposed to different types of odorous substances as chemical sensors which were conventionally called electronic nose or e-nose [9,10] Thus, further studies must be performed towards the reproducibility and stability of these sensors. Polyaniline (PAni) is one of the most promising ICP for presenting thermal stability, processability and highest electrical conductivity among all ICP. These polymers are gaining attention from the scientific community since their electrical conductivity can be markedly altered in contact with a gas and this change can be accurately detected.

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Materials and Method

Synthesis of PANI-HCl Matrix

All the chemical used in the investigation were analytical reagent grade The electro polymerization of aniline was carried out by Galvanostatic technique. The Polyaniline Matrix was synthesized from an aqueous solution of distilled water containing 0.2 M aniline and 1 M of Hydrochloric acid (HCl). After synthesis, polymer coated electrodes were rinsed thoroughly in distilled water and dried in cold air and then used for subsequent characterization.

Result and Discussion:

Galvanostatic studies of PANI-HCl Matrix

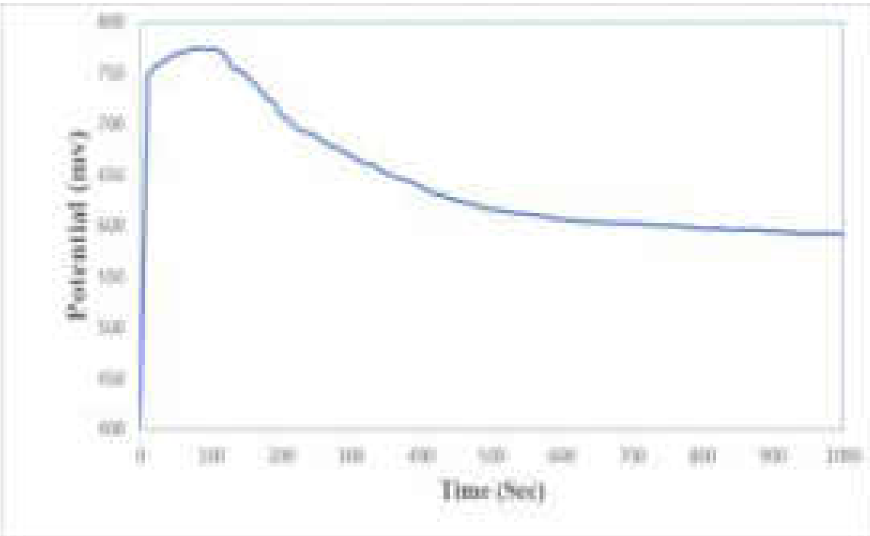

Figure 1. Potential-time curves obtained synthesis of polyaniline Matrix

The PANI-HCl Matrix was synthesized on ITO coated glass from 0.2 M concentration of aniline and 1.0 M of HCl at 1.0 pH and temp 27 °C. The behavior of the potentiometric synthesis overshoot during first few second probably indicates difficult formation of dimmers and oligomers. After this, potential remain constant suggesting that

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building up of the film proceeds according to the same reaction along the full thickness of the polymer as shown in Figure 1.

Conductivity Studies

The electrical conductivity of synthesized PANI-HCl Matrix was measured by four probe technique and it was 0.1315s/cm.

SEM studies

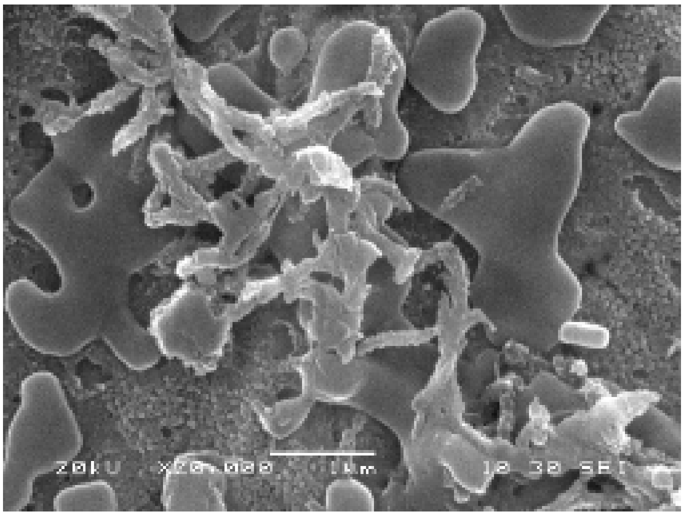

Figure 2. SEM micrograph of PANI-HCl matrix synthesized at 1.0 pH, 0.2 M aniline, 1.0 M HCl T=27 ºC.

The SEM micrograph for synthesized PANI film with optimized process parameters is shown in Fig 2. It is fibrillar like structure good porosity, i

CONCLUSIONS

The PANI-HCl matrix have been successfully synthesized on ITO glass plate has uniform matrix and has conductivity that was confirmed by four probe technique the SEM showed porous and fibrillar structure which is suitable for immobilization of biocomponent and on optical fiber for chemical optical biosensors.

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