Synthesis and electrochemical analysis of TiO_2 thin film prepared by spray pyrolysis technique

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Abstract – In this study, we report electrochemical analysis of TiO_2 thin film electrode. Electrochemistry is a powerful tool to investigate reactions involving electron transfers. TiO_2 thin films got interest in electrochemistry due to its good biocompatibility, large surface area and immobilizing ability. TiO_2 thin film electrode was deposited on glass substrate by Spray pyrolysis technique. Cyclic voltammetry was used to analyze the electrochemical process of the TiO_2 thin film electrode. The electrochemical process of TiO_2 thin film electrode shows that the electron transfer rate was good. TiO_2 thin film electrode also exhibits good linearity and high stability.

Keywords: Thin films; TiO_2; Spray pyrolysis; electrochemical studies

1. INTRODUCTION

In recent years the electrochemical analysis have gained attention in the investigation of important biological molecules and drugs because of their simplicity, cost effectiveness, easy handling and highly sensitive compared to other methods [1]. Electrochemistry explains the flow of electrons into chemical changes. In inorganic chemistry, the chemical change is happened by the oxidation or reduction of a metal complex. Electrochemical cell is used to study the electrochemical processes. It usually has three electrodes and an electrolyte. An electrode is the boundary at which substrates may accept or lose electron(s). An electrolyte is required to supply electrical conductivity between the two electrodes. Cyclic voltammetry (CV) is the first experimental three electrode cell carried out for the electrochemical study of a composite, biological material or an electrode surface.

The cyclic voltammetry is a simple and easy technique and used to examine all types of electrochemical reactions. This method gives information about the reactions type observed in the method and the potentials at which they happen. The plot obtained for current versus applied potential is called as a voltammogram. It provides the quantitative and qualitative information about the species involved in the oxidation or reduction reaction. The applied potential is calculated at the reference electrode, as the counter electrode closes the electrical circuit for the current to flow. The experiments are done by the potentiostat that successfully controls the voltage between the reference and working electrode and measures the current through the counter electrode. The working, reference, and counter/auxiliary electrodes together make up a balanced three electrode system [2].

Now a day's transparent metal oxide thin films are broadly used materials in various applications. The metal oxide semiconductor thin films such as TiO_2, ZnO, and SnO_2 are widely researched and extensively considered for various applications with high performance. Among these TiO_2 is a widely used semiconductor material for various applications such as dye-sensitized solar cells, water photoelectrolysis, photocatalysis, gas sensors, Chemical Oxygen Detection (COD) sensor and biosensor [3]. Environmental friendly TiO_2 thin films got interest in the field of electrochemistry due to its good biocompatibility, immobilizing ability, large surface area and good surface, structural, physical, chemical and optical properties [4].

TiO_2 thin film electrode was fabricated by Spray pyrolysis technique. Spray Pyrolysis is a cost effective, simple and efficient technique. This technique has the capability to produce large surface area, high quality adherent films with uniformity, easiness of