CONTEMPORARY METALLIC MATERIALS

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Chapter 030

Electrodeposition Technique for ZnO Semiconductor Thin Film Fabrication

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Keywords: Electrodeposition technique, Thin films, ZnO semiconductors, Structural properties, Optical properties.

Abstract: Electrodeposition is emerging as a method for the synthesis of semiconductor thin films particularly group II-VI semiconductors. We report here our results in the preparation of ZnO films by potentiostatic electrodeposition. Zinc nitrate aqueous baths were employed for the preparation of the films on ITO conducting glass substrates. Scanning electron microscopy was employed for characterizing the films in terms of morphology. UV-VIS spectroscopy was used for determining the optical characteristics of the samples and XRD was used to determine the crystal structure of the films.

Introduction

Electrodeposition or electroplating is defined as the process in which the deposit of a (usually) thin layer (of metal) is formed upon a substrate (that is often, but not always, also a metal). The purpose of such process may be to enhance or change the appearance of the substrate and/or attributes (such as corrosion resistance). Examples of the use of this method include the deposition of gold or silver on jewelry and utensils, and the deposition of chrome on automobile parts. Electrodeposition is performed in a liquid solution called an electrolyte, otherwise referred to as the "chemical bath". The bath is a specially designed chemical solution that contains the desired metal dissolved in a form of submicroscopic positively charged ions. Additives may also be introduced in the bath to obtain smooth and bright deposits. The object that is to be plated is submerged into the electrolyte and is connected to the negative terminal of the power supply. The positively charged anode completes the electric circuit. A power source in the form of a battery or rectifier provides the necessary current. This type of circuit arrangement directs electrons into a path from the power supply to the cathode. In the bath the electric current is carried by the positively charged ions from the anode towards the negatively charged cathode. This enables the metal ions in the bath to migrate towards extra electrons that are located at or near the surface of the cathode. Finally, the metal ions are removed from the solution and are deposited on the surface of the object as a thin layer. The reaction in aqueous medium at the cathode therefore obeys Eq. 30.1

$$M^{+n} + ne^{-} \Longrightarrow M. \qquad (30.1)$$