ADVANCES IN MATERIALS ENGINEERING

Volume 2

Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
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Chapter 010

Electrochemical Study of Zinc Selenide Thin Films Prepared for Photovoltaic Applications

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Abstract. Polycrystalline thin films of cubic zinc selenide semiconductor have been electrochemically deposited on conducting substrates of indium tin oxide, ITO glass. Initial investigation with voltammetry was done and the influence of deposition potential and of bath temperature on the films crystallinity is discussed. At room temperature, amorphous films were obtained and at elevated bath temperatures between 55 °C and 75 °C, films were crystallined. The best deposition voltage obtained was -0.95 V vs. Ag /AgCl while at lower deposition potentials, the films do not form well. Energy Dispersive Analysis and X-Ray spectrum indicate that the films deposited at 65 °C and -0.95 V vs. Ag/AgCl have nearly stoichiometric Zn: Se ratio. Energy band gap and refractive index are in agreement with reported results.

Introduction

ZnSe is II-VI compound semiconductor (II: Zn, Cd, Hg and VI: S, Se, Te), which is considered a promising material due to its wide band gap and has gained considerable attention. ZnSe is widely used in optoelectronic devices, because its band gap (2.6-2.7 eV) belongs to the visible region [1]. Therefore there is currently a major interest in ZnSe based materials suitable for the fabrication of light-emitting devices operating in the blue-green region [2] and in the manufacture of optical components, mirrors, lenses etc. ZnSe could also be used as a window material in photovoltaic cells if employed as a thin layer [3]. For IR lasers [4, 5]. Several techniques have been used to grow high quality ZnSe thin films, such as molecular beam epitaxy (MBE) [6] and chemical vapor deposition (CVD) [7]. ZnSe can also be prepared through the electrochemical atomic layer epitaxy (ECALE) [8], low pressure metal organic CVD [9], vacuum evaporation [10] and chemical bath deposition [11]. However, there is an interest to investigate other approaches too, which could open new or supplementary possibilities in terms of device properties, structure or engineering. Electrodeposition is the alternative method that is particularly adapted for the deposition of II-VI semiconductor materials. Among the direct wide-band semiconducting materials, the zinc selenide has been the object of numerous studies concerning thin film electrodeposition from aqueous solutions. Recently, electrodeposition has emerged as a simple, economical, low temperature and viable technique, which could produce films of good quality for device applications [12]. The attractive features of this method are the convenience for producing