ADVANCES IN MATERIALS ENGINEERING

Volume 2

Edited By:
Md Abdul Maleque
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68100 BATU CAVES
SELANGOR DARUL EHSAN
TEL: +603-6188 1542 / 44 / 45 FAX: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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Chapter 035

ZnO / Polymer Junction Growth for Hybrid Solar Cell Applications

Souad. A. Mohamad

Faculty of Engineering – International Islamic University Malaysia

✉ : su3ad@iium.edu.my

Keywords: Solar cells, ZnO, Polymer, Electrochemistry, Thin Films

Abstract. A hybrid solar cell is designed and proposed as a feasible and reasonable alternative. With the employment of zinc oxide (ZnO) and polyethylene oxide (PEO) thin films. ITO based thin films of ZnO were deposited by sputtering technique and ITO based thin films of polyethylene were deposited by solution cast technique and used as an active polymer blend. These ITO base thin films were introduced with ZnO and PEO in such a way that, the most effective configuration was optimized to be Ag/ITO/ZnO/PEO/ITO/Ag. All thin films samples were subjected to structural, optical and morphological characterization by; X-Ray, UV-VIS and SEM respectively.

Introduction

Light to electrical energy conversion by dye-sensitized solar cells (DSSCs) was first reported by O' Regan and Gra¨ tzel in 1991 [1]. The injection of electrons from a photo-excited state of the dye sensitizer into the conduction band of the semiconductor upon absorption of light forms the basis for electricity generation in the solar cell. DSSCs based on liquid electrolytes have shown high-energy conversion efficiency that has reached 11% under irradiation of AM 1.5 [2–4] and the production cost compared to that of traditional photovoltaic devices is relatively low. Although the conversion efficiencies of DSSCs based on liquid electrolytes are quite high, there are still problems to be solved. Electrolyte leakage, solvent evaporation, and high-temperature instability are among the many problems. These problems have led to difficulties in sealing and photochemical degradation and have delayed DSSCs from practical uses [5, 6]. To solve these problems, the use of such liquid electrolytes has been replaced by polymer electrolytes [7], which can be prepared in thin film form by solution casting. The conductivity of polymer electrolytes can be optimized with the appropriate amount of salt and plasticizers or inert fillers and they are flexible. Polymer electrolytes can also be prepared in semi-solid or gel form. The use of a gel polymer electrolyte based on poly(acrylonitrile- co-styrene)/NaI+I_2 and a binary solvent mixture containing ethylene carbonate and propylene carbonate on dye-sensitized TiO_2 has been demonstrated in Ref. [8]. Polymer electrolytes can also be formed using blends of different polymers. A polyblend electrolyte of PVP/PEG+KI+I_2 on dye-sensitized TiO_2 has been reported in Ref. [9]. The polymer electrolyte used in this work is a blend of polyethylene oxide (PEO) and chitosan. Chitosan is a biopolymer which has electron-donating atoms in the form of oxygen and nitrogen. The structure and properties of chitosan/PEO films have been reported to exhibit good mechanical properties [10]. Budtova et al. [11] have shown that blending PEO with chitosan does not