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Utilization of MEH-PPV as a sensitizer in titana-based photovoltaic cells

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Abstract

A conjugated polymer poly[2-methoxy-5(2-ethyl-hexyloxy)-p-phenylene vinylene] (MEH-PPV) is utilized as the light-harvesting agent in a photovoltaic cell. Sensitized anodic and cathodic photocurrents are observed for CuCNS|MEH-PPV|TiO₂ cells and heterojunctions with MEH-PPV. © 2005 Elsevier B.V. All rights reserved.

Keywords: MEH-PPV; Photovoltaic cells; Sensitized anodic photocurrent

1. Introduction

Conversion of solar energy into electricity is dominated by the solid-state silicon solar cells. However, the cost of fabrication and requirement(s) of advance technology limit their application as an alternative power source for large-scale practical applications. Dye sensitized photovoltaic cells are potential examples for cheap solar cells [1,2]. Dyes or narrow band-gap semiconductors are generally used as a light-harvesting entity in these types of solar cells. Owing to high absorption coefficient, sufficiently fast diffusion of carries, ionic conductivity of polymers has attracted a considerable attention [3–6]. We have used a polymer {poly[2-methoxy-5(2-ethyl-hexyloxy)-p-phenylene vinylene], MEH-PPV} as the light-harvesting component in a solid-state cell. Sensitized anodic photocurrent is observed for the CuCNS|MEH-PPV|TiO₂ solid-state cell. Performance

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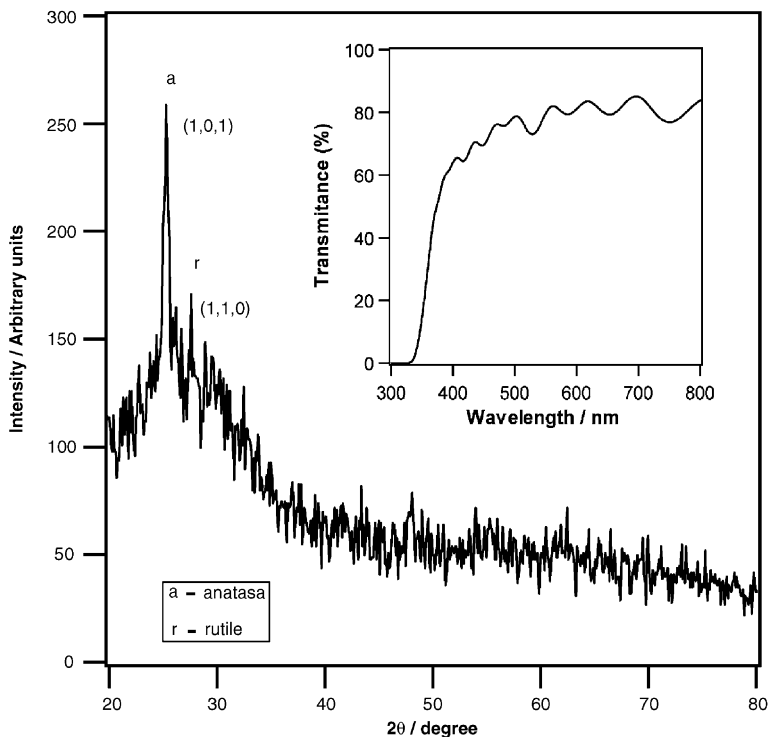


Fig. 1. X-ray diffractogram of TiO_2 films. The inset shows the variation of transmittance of the film with wavelength.

of the cell is compared by replacing the CuCNS layer with a liquid electrolyte. Anodic and cathodic photocurrents are observed for electrolytic cell in the presence and absence of titana base beneath of MEH-PPV layer.

2. Experimental

TiO_2 films with approximate thickness of $5\ \mu\text{m}$ were prepared by applying a colloidal solution of hydrolyzed titanium isopropoxide mixed with TiO_2 powder (P-25 Degussa) on preheated conducting glass plates (ITO) as described elsewhere [7]. MEH-PPV was coated on the TiO_2 films by a dip coating technique. A solution of MEH-PPV in CH_3Cl was used as the coating solution. CuCNS was deposited on MEH-PPV coated TiO_2 films. In brief, CuCNS was digested in propylsulfide at room temperature for 6 h and the residue was separated by centrifugation. A small amount of this solution was spread on MEH-PPV coated TiO_2 electrode heated to $150\ ^\circ\text{C}$ and allowed to dry. A thin layer of graphite was painted on the top of CuCNS layer to improve the conductivity. A mirror type Pt coated ITO was attached to the CuCNS surface as the back contact of the cell. The cells were characterized under monochromatic and polychromatic illuminations ($100\ \text{mW cm}^{-2}$). Absorption and luminescence measurements were carried out using UV-Vis spectrometer (Shimadzu UV-3000), and fluorescence spectrometer (Shimadzu RF-5000), respectively.

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