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Investigation of Optimum Transparent Conductive Oxides (TCOs) for CdS:O/CdTe Thin Film Solar Cells (TFSCs) from Numerical Analysis

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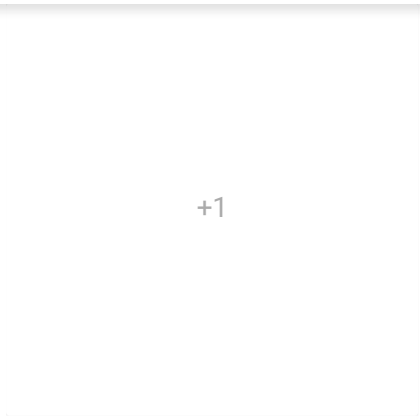
Samiul Islam

Abstract and figures

Transparent Conductive Oxides (TCOs) are an increasingly important component of solar cells, where they act as front electrode elements.The structural templates, diffusion barriers and their work function controls the open circuit voltage(Voc). In this paper, various transparent conductive oxide materials have been studied which are used as the front surface contacts of CdS:O/CdTe based thin film solar cells. Various electrical and optical parameters like work function, thickness, temperature etc., of some common transparent conductive oxides materials such as ZnO, FTO, SnO2etc., are studied. The main idea was to find an optimum conductive oxide layer for CdTe solar cell which shows the great potential in thin film area of solar cell. All the analysis was done by using the widely used simulator Analysis of Microelectronic and Photonic Structures (AMPS 1D). It was observed that both SnO2and ZnOshow similar performance under various conditions. Indium Tin Oxide (ITO) has shown the worst performance among them in all conditions. Fluorinated Tin Oxide (FTO) looked promising match for CdTe solar cells in some conditions.



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RESEARCH ARTICLE

Investigation of Optimum Transparent Conductive Oxides (TCOs) for CdS:O/Cd (TFSCs) from Numerical Analysis.

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Abstract

Transparent Conductive Oxides (TCOs) are component of solar cells, where they act as fr structural templates, diffusion barriers and their open circuit voltage(V_{oc}). In this paper, various t materials have been studied which are used as t CdS:O/CdTe based thin film solar cells. Var parameters like work function, thickness, temper transparent conductive oxides materials such a studied. The main idea was to find an optimum CdTe solar cell which shows the great potential i All the analysis was done by using the widely Microelectronic and Photonic Structures (AMPS both $SnO_2$and ZnOshow similar performance Indium Tin Oxide (ITO) has shown the worst per conditions. Fluorinated Tin Oxide (FTO) looked solar cells in some conditions.

Introduction: -

Cadmium Telluride (CdTe) is a promising material for solar cells as it has an ideal energ and larger absorption coefficient (>5×10^5/cm) [M. Hadrich et al., J. Britt et al.]. The pol to be the best-suited hetero-junction n-type partner with p-type CdTe absorber for CdS. CdTe cells already achieved efficiency of 16.5% in laboratory and commercial modules 10% [X. wu et al.]. CdTe solar cells use Transparent Conductive Oxides (TCO) as optically transparent and electrically conductive materials. [Hecht, D. S et al.]

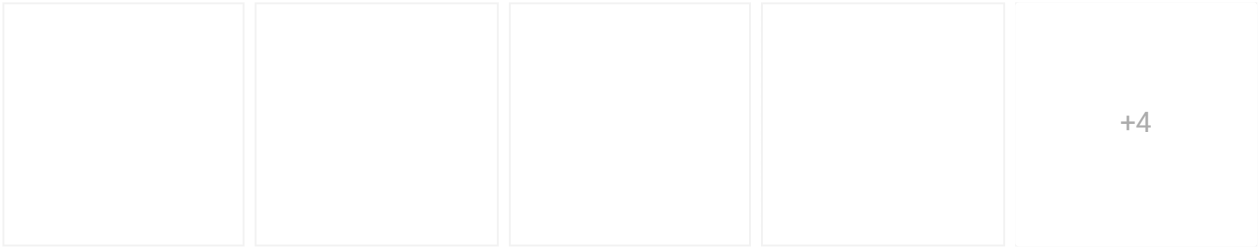
Major considerations in the choice of the TCO for the solar cell, besides the conduc electronic compatibility with the adjacent layers in the cell, processing requirer environmental conditions. A carrier concentration on the order of 10^{20} cm^{-3}or higher ar 3eV are usually for high conductivity. As with all transparent conducting films, a tradeo conductivity and transparency, since increasing thickness and the carrier concer conductivity, but decreases the transparency.

Features of TCO: -

TCO for solar cell applications have been fabricated from both inorganic and organic r

- High transparency in visible light and more than that to enhance efficiency.
- High conductance.

Similar research



A study towards the possibility of ultra thin Cds/CdTe high efficiency solar cells from numerical analysis

Article · Full-text available

January 2010

Mahmud Matin · Nowshad Amin · Azami Zaharim · Kamaruzzaman Bin Sopian

Polycrystalline cadmium telluride (CdTe) is the leading material for realization of low cost and high efficiency solar cell for terrestrial use. In this work, a conventional structure of CdTe thin film solar cells [1] was investigated and conversion efficiency as high as 13.2% was achieved with the CdTe…

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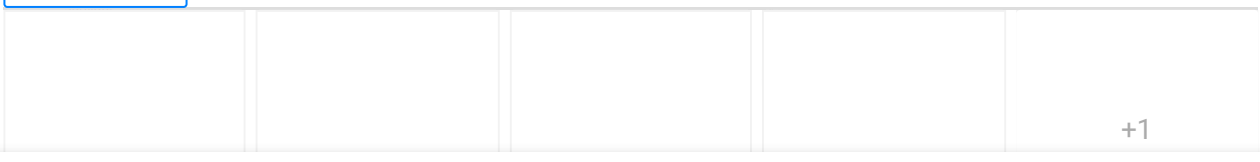

Numerical Analysis on Prospects of High Efficiency CdS/CdTe Thin Film Solar Cell

Conference Paper | Full-text available

September 2014 · 2014 IEEE Symposium on Industrial Electronics and Applications (ISIEA), Sept 28...

Mohammad Hossein Pourdadash · Mohammadreza Aghaei

Photovoltaic (PV) energy is one of the significant renewable energies with free and permanent resource. Cadmium Telluride (CdTe) is from group II-VI of compound polycrystalline semiconductors. The CdTe solar cell material can be produced in thinness of film; hence, it is very appropriate for thi…

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Article | Full-text available

January 2013 · International Journal of Photoenergy

Tingliang Liu · Xing Zhang · Jingquan Zhang · [...] · Bing Li

Transparent ITO/ZnO and ITO/SnO2 complex conductive layers were prepared by DC- and RF-magnetron sputtering. Their structure and optical and electronic performances were studied by XRD, UV/Vis Spectroscopy, and four-probe technology. The interface characteristic and band offset of th…

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Design Optimization of CdTe Thin Film Solar Cells from Numerical Analysis

Conference Paper | Full-text available

December 2014 · 8th International Conference on Electrical and Computer Engineering (ICECE 2014)

Naveed Aziz Khan · Kazi Sajedur Rahman · Faiazul Haque · [...] · Nowshad Amin

In this paper, a modified structure for CdTe thin film solar cell was proposed by numerical analysis with an addition of a novel ZnO buffer to improve the conversion efficiency. The CdS window layer was reduced to 50 nm together with the insertion of zinc oxide (ZnO) as the buffer layer to prevent…

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Article

April 2013 · Nanoscience and Nanotechnology Letters

materials, the need to obtain highly performing indium-free transparent conducting layers for photovoltaic and optoelectronic applications is continuously growing. Aluminum-doped ZnO is a…