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The vision behind organizing this conference is to provide an excellent forum for researchers, scientist and industrialist from interdisciplinary areas to showcase their current contribution in the recent area of Physical Sciences. The objectives of International Conference on Computational Applied Sciences and it's Applications (ICCASA-2025) are to abreast the young minds from Institutes, Universities, Colleges and Industries across the country, with the latest advancements in the field of this area, and providing them an opportunity to share their recent researches and views in various fields of Physical Sciences and their applications for the ultimate benefit of the Society and Industry. The broad aim of the conference is to groom the young scientists' minds to face the challenges of future for effective and efficient professional responsibilities. The conference will cover a wide range of topics in the form of plenary speakers, keynote speakers, invited talks & contributory papers presentations.

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addressing these nutritional and external determinants, effective prevention strategies for DR can be developed, promoting healthier outcomes for individuals with diabetes.

TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis

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Abstract: In this study, the optical and electrical characteristics of a newly designed quantum dot solar cell (QDSC) incorporating cadmium telluride (CdTe) quantum dots were investigated. Simulations were carried out using the Silvaco TCAD ATLAS platform. The modeled configuration featured CdTe quantum dots embedded in the active region, followed by a gallium arsenide (GaAs) layer, a nickel oxide (NiO) hole transport layer, and a zinc oxide electron transport layer. Unlike conventional photovoltaic devices, QDSCs exhibit multiple exciton generation (MEG), allowing a single absorbed photon to generate multiple charge carriers, thereby enhancing their potential efficiency. The parameters obtained were said to have an output power efficiency, V_{oc}, J_{sc}, and fill factor of 36.95%, 1.054 V, 45.8 mA/cm², and 0.76, respectively, under simulated AM1.5g illumination at normal incidence. The formed structure was able to separate charge, reduce recombination loss, and optimize the absorption of photons at wavelengths between 300 and 750 nm. The calculated parameters, such as the J-V profile and characteristic absorbance at different wavelengths, and the energy band diagram show that the proposed CdTe QDSC is a viable option because of its scalability and performance. Temperature analysis across 300-350 K was also performed which showed that the solar cell is stable and depicts predicted trends according to the theoretical studies present. Accordingly, in this work, critical information on designing and optimising future-generation solar cells is pointed out, and the significance of QDSCs in future-generation cutting-edge renewable energy technologies are also highlighted.

Keywords. GaAs/CdTe Quantum Dots, Solar cell, Multiple excitation generation (MEG), Output Power Efficiency, Fill factor.

University of Engineering & Management, Jaipur

3rd International Conference on Computational Applied Sciences & it's Applications (ICCASA-2025)

CERTIFICATE OF APPRECIATION

This is to certify that Ms./Mr./Prof./Dr.

Arighna Bhattacharjee

of Institute of Engineering and Management, Kolkata has presented a paper entitled "TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis" at 3rd International Conference on Computational Applied Sciences and Its Applications (ICCASA-2025), organized by the Department of Basic Sciences, University of Engineering & Management, Jaipur, held on September 20-21, 2025. We express our sincere appreciation for the valuable contribution towards the success of the conference.

Dr. Praphull Chhabra	Dr. Tarun Sharma	Dr. Arnab Palui	Prof. (Dr.) Biswajoy Chatterjee	Prof. (Dr.) Pradeep Kumar Sharma
Convener, ICCASA-2025	Convener, ICCASA-2025	Co-Convener, ICCASA-2025	Vice Chancellor, UEM Jaipur	Registrar & Provost, UEM Jaipur

TCAD Based Modeling of a GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration and Thermal Analysis

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Abstract. In this study, the optical and electrical characteristics of a newly designed quantum dot solar cell (QDSC) incorporating cadmium telluride (CdTe) quantum dots were investigated. Simulations were carried out using the Silvaco TCAD ATLAS platform. The modeled configuration featured CdTe quantum dots embedded in the active region, followed by a gallium arsenide (GaAs) layer, a nickel oxide (NiO) hole transport layer, and a zinc oxide electron transport layer. Unlike conventional photovoltaic devices, QDSCs exhibit multiple exciton generation (MEG), allowing a single absorbed photon to generate multiple charge carriers, thereby enhancing their potential efficiency. The parameters obtained were said to have an output power efficiency, V_{oc}, J_{sc}, and fill factor of 36.95%, 1.054 V, 45.8 mA/cm^2, and 0.76, respectively, under simulated AM1.5g illumination at normal incidence. The formed structure was able to separate charge, reduce recombination loss, and optimize the absorption of photons at wavelengths between 300 and 750 nm. The calculated parameters, such as the J–V profile and characteristic absorbance at different wavelengths, and the energy band diagram show that the proposed CdTe QDSC is a viable option because of its scalability and performance. Temperature analysis across 300–350 K was also performed which showed that the solar cell is stable and depicts predicted trends according to the theoretical studies present. Accordingly, in this work, critical information on designing and optimising future-generation solar cells is pointed out, and the significance of QDSCs in future-generation cutting-edge renewable energy technologies are also highlighted.

INTRODUCTION

The global shift towards the use of renewable sources of energy has spurred extensive research on more efficient solar cells, and this has resulted in new concepts and designs. Among them, quantum dot solar cells (QDSCs) have emerged as a promising candidate due to their greater capacity to absorb light in comparison to conventional designs. Compared to conventional solar cells, QDSCs employ nanoscale quantum dots that have quantum confinement effects, which facilitate the process of multiple exciton generation (MEG) [1]. In the process of MEG, a single high-energy photon can generate multiple pairs of electron-hole carriers, thus increasing the device efficiency above the theoretical Shockley and Queisser limit. This is facilitated by their bandgap tunability property, which allows the adjustment of the absorption spectrum by varying the size and ordering of the quantum dots [2]. This study aims to investigate ways to improve efficiency and operation stability of quantum dot-based solar cells (QDSCs). Recent research has shown remarkable advancements in model and simulation studies utilizing advanced device simulation software, like Silvaco TCAD. For example, Dong et al. [1] carried out extensive analyses of InAs/GaAs QDSCs and, in another publication, investigated the integration of quantum dots with gallium arsenide solar cells [2]. Mehrabian et al. also used Silvaco ATLAS for numerical modeling of CdS quantum dot-sensitized structures [3], thus complementing Ahmed et al.'s [4] in-depth evaluation of solar cell performance trends by different technological generations with particular emphasis on quantum dot technologies. Walker et al. investigated how doping levels and the spatial positioning of quantum dots influence the performance of multi-junction solar cells [5, 6]. Rahamathulla et al. modeled CdS/CdTe solar cells incorporating nano-wells with gold nanorods to enhance efficiency [7]. Abbasian et al. examined the role of HBL and EBL (hole/electron blocking layers) in InAs/GaAs multiple-quantum-well devices [8]. Likewise, Mehrabian et al. studied bilayer perovskite quantum dot solar cells, achieving a simulated efficiency of 18.55% [9]. De Sarkar et al. focused on optimizing Si/GaP quantum dot cells [10], while Ahmed et al. analyzed the effect of quantum dot integration on average solar cell efficiency [11]. Islam et al. modelled an InGaN-based quantum well solar cell using Silvaco TCAD [12], and Bittner et al. incorporated quantum dots and quantum wells in InGaAs metamorphic subcells for hard-radiation photovoltaics [13]. Jaouane et al. simulated the effect of quantum dot concentration on solar cell characteristics [14]. Pandey et al., though, utilized device simulations to optimize PbS colloidal quantum dot solar

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Acceptance of your paper "TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis" for publication in the AIP Conference Proceedings

1 message

UEMK iccasa <iccasa@uem.edu.in> 2 September 2025 at 15:12
To: "arighnabhattacharjee003@gmail.com" <arighnabhattacharjee003@gmail.com>

Subject: Acceptance of your paper **"TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis"** for publication in the **AIP Conference Proceedings** of the 3rd International Conference of Computational Applied Sciences and its Applications [ICCASA -2025].

Dear Arighna Bhattacharjee,

Greetings of the day!

We are pleased to inform you that your paper titled **"TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis"** has been reviewed and accepted for publication in **AIP Conference Proceedings** of the *3rd International Conference of Computational Applied Sciences and its Applications [ICCASA -2025],* scheduled to be held on **20-21 September 2025** at the **University of Engineering and Management, Jaipur.**

We congratulate you on the acceptance of your contribution and thank you for your valuable work. Further details regarding the presentation schedule, online platform link, and guidelines for preparing the final manuscript [camera-ready paper] will be communicated soon.

You are advised to complete the registration process before the due date (if not done yet) and present the paper as per the presentation schedule and guidelines of the conference.

We look forward to your active participation and to welcoming you at the conference.

Link of Registration: https://forms.gle/c4JDVkMCTwBRFaZx5

Link of Conference Website: https://iccasa.uem.edu.in/

With best regards,

Organizing Team

ICCASA 2025

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