



PROCEEDINGS

7th International Conference on Multidisciplinary Approaches -2020

*“Multidisciplinary Approach to Overcome Challenges Posed by Covid-19
towards National & Global Development”*

Organized by
Faculty of Graduate Studies
University of Sri Jayewardenepura
Nugegoda, Sri Lanka

08^h & 09th December 2020

International Conference on Multidisciplinary Approaches – 2020

**“Multidisciplinary Approach to Overcome Challenges
Posed by COVID-19 - Towards National & Global
Development”**

Conference Proceedings

8th & 9th December 2020

Faculty of Graduate Studies
University of Sri Jayewardenepura
Nugegoda, Sri Lanka

Proceedings of the 7th International Conference on Multidisciplinary
Approaches (*iCMA*) – 2020

Faculty of Graduate Studies
University of Sri Jayewardenepura
Nugegoda
Sri Lanka

148 Pages

ISSN: 2386 – 1509

Copyright © *iCMA*

Published by:
Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda,
Sri Lanka

Tel: +94 112881571

Fax: +94 112802551

Email: icma@sjp.ac.lk

Official website of the Conference

<http://www.graduate.sjp.ac.lk/icma>

Disclaimer

The responsibility for opinions expressed, in articles, studies and other contributions in this publication rest solely with their authors, and this publication does not constitute an endorsement by the *iCMA*-2020 of the opinions so expressed in them.

Editor in Chief

Snr. Prof. M.M. Pathmalal - Dean, Faculty of Graduate Studies

Editorial Committee

Snr. Prof. R.G. Ariyawansa
Snr. Prof. J.K.P. Wanigasuriya
Prof. C.A.D. Nahallage
Prof. T.M.S.P.K. Thennakoon
Prof. W.M. Dhanapala
Prof. W.M. Yaparathne
Prof. P.M. Jayaweera
Prof. R.A.U.J. Marapana
Dr. A.R. Ajward
Dr. A.N. Fernando
Dr. N.C. Ganegoda
Dr. N.R. Samaranayake
Dr. B.C.V. Senarathna
Dr. W.L.I. Wijesekara
Dr. Nayana Wijayathilaka

Language Editors

Dr. Praneeth Abhayasundere
Dr. M.G. Lalith Ananda

Conference Secretariat

Mrs. I.B.S.S. Irugalbandara
Dr. G.Y. Liyanage
Dr. S.P. Chandrasiri
Mrs. D.S.W. Serasinghe
Mr. L.H.K.P. De Silva
Mr. W.K.M. Wijayarathna
Mr. C.P.G. Ekanayake

Page layout

Mr. A.H.M. Atheeq

Cover Page Design by

Mr. K.G. Ranawaka
Mr. K.C. Ranasinghe

A NUMERICAL SIMULATION STUDY OF THE PERFORMANCES OF 3D/2D PEROVSKITE SOLAR CELL AFTER INTRODUCING THE DEFECTS IN THE 3D PEROVSKITE LAYER

Adihetty N.L.¹, Ratnasinghe D.R.¹, Attygalle M.L.C.^{2*}, Narayan N.S.³
and Jha P.K.³

¹Faculty of Graduate Studies, University of Sri Jayewardenepura, Sri Lanka

²Department of Physics, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Sri Lanka

³Department of Physics, Faculty of Science,
The Maharaja Sayajirao University of Baroda, Gujarat, India
lattygalle@sci.sjp.ac.lk

Abstract

This is a numerical simulation study of a thin film hybrid organic-inorganic perovskite solar cell with a p-i-n structure. The p-type semiconductor layer is an organic hole transporting material (HTM) called Poly (3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS). In this new device structure, we have intentionally included a double intrinsic layer (i) of 3D Methylammonium Lead Iodide ($\text{CH}_3\text{NH}_3\text{PbI}_3$) (MAPI) and the 2D monolayer of $\text{CH}_3\text{NH}_3\text{PbI}_3$ to minimize the degradation of the device, and also embedded deep and shallow defects in the 3D-MAPI layer. The n-type material, fullerene derivative (6,6)-phenyl-C61-butyric acid methyl ester (PCBM) is used as an organic electron transporting material (ETM). The solar cell performance has changed after including defects in the 3D-MAPI since the defects can alter the dark saturation current of the device. The simulation results show that the shallow defects and deep defects of 3D-MAPI can alter the open-circuit voltage of the perovskite solar cell model. The open-circuit voltage of the solar cell model depends on the dark saturation current, which indicates how much recombination is occurring in a semiconductor. The deep defects of 3D-MAPI should be minimized to increase the cell performance since the high dark saturation current decreases the open-circuit voltage of the solar cell. We have observed that Shockley-Read-Hall recombination is the most predominant recombination mechanism for the deep defects in the 3D-MAPI materials.

Keywords: perovskite-based solar cell, recombination, thin-films, dark saturation current, defects