

[< Back to results](#) | 1 of 1[Download](#) [Print](#) [Save to PDF](#) [Save to list](#) [Create bibliography](#)***Journal of Mechanical Science and Technology*** • 2023**Document type**

Article

Source type

Journal

ISSN

1738494X

DOI

10.1007/s12206-022-0806-2

Publisher

Korean Society of Mechanical Engineers

Original language

English

[View less](#)

Characterization and application of nano-composite zinc oxide/poly vinyl alcohol thin-film in solar cell performance enhancement

Khan, Shaheer Ahmed^{a, b, c} ; Rahman, Ataur^a ; Khan, Wajahat^b; Haider, Syed Mustafa^d [Save all to author list](#)^a Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, KL, 50728, Malaysia^b Department of Engineering Sciences, Pakistan Navy Engineering College (PNEC), National University of Sciences and Technology (NUST), Karachi, 75350, Pakistan^c Department of Materials Engineering, NED University of Engineering and Technology (NEDUET), Karachi, 75270, Pakistan^d Department of Industrial and Manufacturing Engineering, Pakistan Navy Engineering College (PNEC), National University of Sciences and Technology (NUST), Karachi, 75350, Pakistan[Full text options](#) [Export](#) **Abstract**[Author keywords](#)[Indexed keywords](#)[SciVal Topics](#)[Funding details](#)**Abstract**

Flexible, economical, and low-toxic organic solar cells are becoming highly popular in photovoltaic research. Interestingly, its efficiency of energy conversion remains lower than that of silicon-based solar cells. As a result, it is unavoidable to focus on organic solar cell efficiency enhancement. This article presents a nano-composite thin-film developed using zinc oxide (ZnO) and polyvinyl alcohol (PVA) with a solution casting technique varying weight percentage (wt.%) of ZnO into the PVA matrix.

Cited by 0 documents

Inform me when this document is cited in Scopus:

[Set citation alert >](#)**Related documents**

Performance investigation of ZnO/PVA nanocomposite film for organic solar cell

Khan, S.A. , Zain, Z.M. , Mansoor, M. (2021) *Materials Today: Proceedings*

The impact of film thickness on the properties of ZnO/PVA nanocomposite film

Khan, S.A. , Rahman, A. , Ibrahim, F.B.D.-A. (2021) *Materials Research Express*

ZnO–PVA Polymer Matrix with Transition Metals Oxide Nanofillers for High Dielectric Mediums

Iqbal, T. , Irfan, M. , Ramay, S.M. (2020) *Journal of Polymers and the Environment*[View all related documents based on references](#)

Find more related documents in Scopus based on:

[Authors >](#) [Keywords >](#)


The characterization of the thin-film of ZnO/PVA has been made using SEM, XRD, FTIR, and UV-Vis spectroscopy. The characterization reveals that the ZnO nanoparticle network forms an excellent path for electron flow in the PVA matrix at the optimal ZnO concentration of 16.66 % and a PVA concentration of 83.33 %. The thin film was applied to an organic solar cell of architecture consists of carbon fiber reinforced with ZnO-epoxy resin/CuO-epoxy resin for performance investigation. The solar cell's maximum efficiency was determined to be 9.01 % before and 14.65 % after using the nano-composite film. 5.64 % increase in the efficiency of organic solar cells are observed after the ZnO/PVA nanocomposite thin film is applied. © 2023, The Korean Society of Mechanical Engineers and Springer-Verlag GmbH Germany, part of Springer Nature.

Author keywords

Energy conversion efficiency; Organic solar cell; Photovoltaic power; Solution casting technique; Zinc oxide/poly vinyl alcohol thin film

Indexed keywords 

SciVal Topics  

Funding details 

References (28)

[View in search results format >](#)

All

[Export](#)  [Print](#)  [E-mail](#)  [Save to PDF](#) [Create bibliography](#)

-
- 1 Khan, S.A., Rahman, A.
Efficiency of thin film photovoltaic paint: A brief review
(2019) *International Journal of Recent Technology and Engineering*, 7 (6), pp. 163-169. Cited 7 times.
<https://www.ijrte.org/wp-content/uploads/papers/v7i6s/F02330376S19.pdf>
-
- 2 Tessema Mola, G., Mbuyise, X.G., Oseni, S.O., Dlamini, W.M., Tonui, P., Arbab, E.A.A., Kaviyarasu, K., (...), Maaza, M.
Nanocomposite for solar energy application
(2018) *Nano Hybrids and Composites*, 20, pp. 90-107. Cited 23 times.
-
- 3 Rahman, A., Kibria, G.
Energy storage Al-ZnO/CuO_CFRP organic structural auxiliary power system for electric vehicle
(2020) *Solid State Technology*, 26 (1-2), pp. 124-131.
-
- 4 Bouzerara, R., Achour, S., Tabet, N., Zerkout, S.
Synthesis and characterisation of ZnO/PVA composite nanofibres by electrospinning
(2011) *International Journal of Nanoparticles*, 4 (1), pp. 10-19. Cited 12 times.
<http://www.inderscience.com/ijnp>
doi: 10.1504/IJNP.2011.038247
[View at Publisher](#)
-

-
- 5 Kochi, R., Crasta, V., Kumar, R., Shetty, G.
Study of structural, optical and photoluminescence properties of ZnO doped PVA/PVP nanocomposite

(2019) *AIP Conference Proceedings*, 2100, art. no. 020045. Cited 8 times.
<http://scitation.aip.org/content/aip/proceeding/aipcp>
ISBN: 978-073541830-1
doi: 10.1063/1.5098599

View at Publisher
-
- 6 Mohammed, N.J., Rasheed, Z.S., Hassan, A.S.
Improvement optical properties of PVA/TiO₂ and PVA/ZnO nanocomposites
(2019) *Al-Mustansiriyah Journal of Science*, 29 (3), pp. 118-123. Cited 12 times.
-
- 7 Ambrosio, R., Carrillo, A., Mota, M.L., de la Torre, K., Torrealba, R., Moreno, M., Vazquez, H., (...), Vivaldo, I.
Polymeric nanocomposites membranes with high permittivity based on PVA-ZnO nanoparticles for potential applications in flexible electronics

(2018) *Polymers*, 10 (12), art. no. 1370. Cited 76 times.
<https://www.mdpi.com/2073-4360/10/12/1370/pdf>
doi: 10.3390/polym10121370

View at Publisher
-
- 8 Shanshool, H.M., Yahaya, M., Yunus, W.M.M., Abdullah, I.Y.
Investigation of energy band gap in polymer/ZnO nanocomposites

(2016) *Journal of Materials Science: Materials in Electronics*, 27 (9), pp. 9804-9811. Cited 74 times.
doi: 10.1007/s10854-016-5046-8

View at Publisher
-
- 9 Abdel-Galila, A., Alib, H.E., Balboula, M.R.
Nano-ZnO doping induced changes in structure, mechanical and optical properties of PVA films
(2015) *Arab Journal of Nuclear Science and Applications*, 48 (2), pp. 77-89. Cited 12 times.
-
- 10 Hemalatha, K.S., Rukmani, K., Suriyamurthy, N., Nagabhushana, B.M.
Synthesis, characterization and optical properties of hybrid PVA-ZnO nanocomposite: A composition dependent study

(2014) *Materials Research Bulletin*, 51, pp. 438-446. Cited 150 times.
doi: 10.1016/j.materresbull.2013.12.055

View at Publisher
-
- 11 Viswanath, V., Nair, S.S., Subodh, G., Muneera, C.I.
Zinc oxide encapsulated poly (vinyl alcohol) nanocomposite films as an efficient third-order nonlinear optical material: Structure, microstructure, emission and intense low threshold optical limiting properties

(2019) *Materials Research Bulletin*, 112, pp. 281-291. Cited 23 times.
<http://www.sciencedirect.com/science/journal/00255408>
doi: 10.1016/j.materresbull.2018.12.022

View at Publisher
-

- 12 Roy, A.S., Gupta, S., Sindhu, S., Parveen, A., Ramamurthy, P.C.
Dielectric properties of novel PVA/ZnO hybrid nanocomposite films
(2013) *Composites Part B: Engineering*, 47, pp. 314-319. Cited 201 times.
doi: 10.1016/j.compositesb.2012.10.029
View at Publisher
-
- 13 Pearton, S.J., Norton, D.P., Ip, K., Heo, Y.W., Steiner, T.
Recent progress in processing and properties of ZnO
(2005) *Progress in Materials Science*, 50 (3), pp. 293-340. Cited 1730 times.
doi: 10.1016/j.pmatsci.2004.04.001
View at Publisher
-
- 14 Rahman, A., Aung, K.M., Khan, S.A.
Organic photoelectric-supercapacitor power source of electric vehicle
(2020) *Engineering and Management*, 82, pp. 15175-15182. Cited 3 times.
-
- 15 Tyona, M.D., Osuji, R.U., Ezema, F.I., Jambure, S.B., Lokhande, C.D.
Enhanced photoelectrochemical solar cells based on natural dye-sensitized Al-doped zinc oxide electrodes
(2016) *Advances in Applied Science Research*, 7, pp. 18-31. Cited 14 times.
-
- 16 Jongnavakit, P., Amornpitoksuk, P., Suwanboon, S., Ratana, T.
Surface and photocatalytic properties of ZnO thin film prepared by sol-gel method
(2012) *Thin Solid Films*, 520 (17), pp. 5561-5567. Cited 81 times.
doi: 10.1016/j.tsf.2012.04.050
View at Publisher
-
- 17 Mohammed, N.J., Rasheed, Z.S., Hassan, A.S.
Improvement optical properties of PVA/TiO₂ and PVA/ZNO nanocomposites
(2019) *Al-Mustansiriyah Journal of Science*, 29 (3), pp. 118-123. Cited 12 times.
-
- 18 MacHado, G., Guerra, D.N., Leinen, D., Ramos-Barrado, J.R., Marotti, R.E., Dalchiale, E.A.
Indium doped zinc oxide thin films obtained by electrodeposition
(2005) *Thin Solid Films*, 490 (2), pp. 124-131. Cited 107 times.
doi: 10.1016/j.tsf.2005.04.042
View at Publisher
-
- 19 Abdullah, Z.W., Dong, Y., Davies, I.J., Barbhuiya, S.
PVA, PVA Blends, and Their Nanocomposites for Biodegradable Packaging Application
(2017) *Polymer - Plastics Technology and Engineering*, 56 (12), pp. 1307-1344. Cited 161 times.
www.tandf.co.uk/journals/titles/03602559.asp
doi: 10.1080/03602559.2016.1275684
View at Publisher
-

- 20 Mahanta, N., Valiyaveetil, S.
Surface modified electrospun poly(vinyl alcohol) membranes for extracting nanoparticles from water
(2011) *Nanoscale*, 3 (11), pp. 4625-4631. Cited 82 times.
doi: 10.1039/c1nr10739a
View at Publisher
-
- 21 Aslam, M., Kalyar, M.A., Raza, Z.A.
Polyvinyl alcohol: A review of research status and use of polyvinyl alcohol based nanocomposites (Open Access)
(2018) *Polymer Engineering and Science*, 58 (12), pp. 2119-2132. Cited 301 times.
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1548-2634](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1548-2634)
doi: 10.1002/pen.24855
View at Publisher
-
- 22 Peng, Z., Kong, L.X., Li, S.-D., Spiridonov, P.
Poly(vinyl alcohol)/silica nanocomposites: Morphology and thermal degradation kinetics
(2006) *Journal of Nanoscience and Nanotechnology*, 6 (12), pp. 3934-3938. Cited 46 times.
doi: 10.1166/jnn.2006.666
View at Publisher
-
- 23 Kumar, N.B.R., Crasta, V., Praveen, B.M.
Advancement in microstructural, optical, and mechanical properties of PVA (Mowiol 10-98) doped by ZnO nanoparticles (Open Access)
(2014) *Physics Research International*, 2014, art. no. 742378. Cited 61 times.
<http://www.hindawi.com/journals/phys/>
doi: 10.1155/2014/742378
View at Publisher
-
- 24 Mansour, A.F., Mansour, S.F., Abdo, M.A.
Improvement structural and optical properties of ZnO/PVA nanocomposites
(2015) *IOSR Journal of Applied Physics*, 7 (2), pp. 60-69. Cited 96 times.
-
- 25 Kandulna, R., Choudhary, R.B.
Concentration-dependent behaviors of ZnO-reinforced PVA-ZnO nanocomposites as electron transport materials for OLED application
(2018) *Polymer Bulletin*, 75 (7), pp. 3089-3107. Cited 41 times.
doi: 10.1007/s00289-017-2186-9
View at Publisher
-
- 26 Kumar, D., Jat, S.K., Khanna, P.K., Vijayan, N., Banerjee, S.
Synthesis, characterization, and studies of PVA/Co-doped ZnO nanocomposite films
(2012) *International Journal of Green Nanotechnology: Biomedicine*, 4 (3), pp. 408-416. Cited 38 times.
doi: 10.1080/19430892.2012.738509
View at Publisher
-

- 27 Fernandes, D.M., Hechenleitner, A.A.W., Lima, S.M., Andrade, L.H.C., Caires, A.R.L., Pineda, E.A.G.

Preparation, characterization, and photoluminescence study of PVA/ZnO nanocomposite films ([Open Access](#))

(2011) *Materials Chemistry and Physics*, 128 (3), pp. 371-376. Cited 114 times.

doi: 10.1016/j.matchemphys.2011.03.002

[View at Publisher](#)

- 28 Sabara, O.M., Dunne, J.S., Pedro, A.Q.H., Trifunović, J., Kotlicic, O., Serrano, A., Kertész, I.

Spectroscopic studies of naproxen and tryptophan immobilized in polyvinyl alcohol

(2011) *Biotechnology and Food Science*, 75 (1), pp. 39-49. Cited 16 times.

👤 Khan, S.A.; Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, KL, Malaysia;

email:shaheer.ahmedkhan@yahoo.com

👤 Rahman, A.; Department of Mechanical Engineering, Faculty of Engineering, International Islamic University Malaysia, KL, Malaysia; email:arat@iiu.edu.my

© Copyright 2023 Elsevier B.V., All rights reserved.

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions ↗](#) [Privacy policy ↗](#)

Copyright © Elsevier B.V. ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies ↗.

