YSCMR 2021

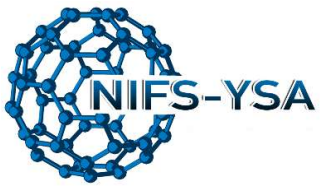
Proceedings of the

Young Scientists' Conference on Multidisciplinary Research - 2021

Virtual International Conference

21st October 2021

"Multidisciplinary Research for Tomorrow's Challenges"



ISSN 2815-0260
Proceedings of the Young Scientists' Conference on Multidisciplinary Research-2021
Young Scientists' Association, National Institute of Fundamental Studies, Sri Lanka
21st October, 2021

Fabrication and characterization of dye-sensitized solar cells based on vein graphite /Lead sulfide nanoparticles composite counter electrode

J.M.K.W. Kumari[1,2*], M.A.K.L. Dissanayake[1,2] and G.K.R. Senadeera[1,3]

[1] National Institute of Fundamental Studies, Kandy, Sri Lanka
[2]Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
3 Department of Physics, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka

** kalpani.ku@nifs.ac.lk*

Background: As a potential candidate of low-cost, third generation photovoltaic device, dye-sensitized solar cells (DSSCs) have attracted increasing attention. The counter electrode (CE) is one of the major components of a DSSC. The role of the CE is to collect electrons from the external circuit and then transfer them into the redox electrolyte by catalysing the reduction of oxidized species in the electrolyte. The ideal CE materials should exhibit high electrocatalytic activity toward electrolyte regeneration, excellent electronic conductivity, good chemical stability, and low production costs. Considering the above properties, carbonaceous materials would be promising candidates for CE materials compared to other types of CE materials.

Objectives: In this study, we have used Sri Lankan vein graphite to investigate the electro catalytic activity and replace the expensive Pt CE in DSSC applications with low cost material.

Methods: Sri Lankan vein graphite based CEs were prepared using a simple spray technique. To improve the power conversion efficiency, we have introduced lead sulphide (PbS) nanoparticles as a transition metal sulphide into the graphite matrix. To assemble PbS nanoparticles on graphite CEs, successive ionic layer adsorption and reaction (SILAR) method was used. Prepared composite material was characterized using scanning electron microscopy and the cyclic voltammetry (CV) was performed to study the electrochemical performance of CEs.

Results: The photovoltaic performance of composite CE based DSSCs were optimized by varying the number of SILAR cycles from 1 to 4. With the increasing number of SILAR cycles, the power conversion efficiency was increased up to 2 SILAR cycles, but further increasing the number of SILAR cycles from 3 to 4, the performance was reduced.

Conclusion: The best power conversion efficiency of 6.42 % can be obtained for 2 SILAR cycles, which is higher than the pristine graphite based device (5.01 %) but lower than the Pt-based device (8.12 %), fabricated under similar conditions.

Keywords: *Graphite counter electrode, PbS nanoparticles, Dye-sensitized solar cells.*

Acknowledgement: Financial assistance from National Science Foundation of Sri Lanka (Grant No: NSF-PSF/ICRP/2017/EA&ICT/04) is gratefully acknowledged.