RESCON 2025 PS 52

EFFECT OF SINTERING TEMPERATURE OF ACTIVATED CARBON/GRAPHITE/PLATINUM NANOPARTICLE COMPOSITE COUNTER ELECTRODES ON THE PERFORMANCE OF DYE-SENSITIZED SOLAR CELLS

P.U. Sandunika[1,2]*, M.A.K.L. Dissanayake[1], G.K.R. Senadheera[1,3] and J.M.K.W. Kumari[1]

[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, Nugegoda, Sri Lanka.*
*ushanisandunika78@gmail.com

The development of efficient and low-cost counter electrodes (CEs) is essential for improving the performance of dye-sensitized solar cells (DSCs) as well as their commercialisation. Platinum (Pt) sputtered electrodes are widely used as counter electrodes, despite their high-cost, limited abundance, and susceptibility to corrosion by the electrolyte. In order to address this problem associated with Pt, alternative counter electrode materials have been developed in the recent past. In this study, a novel composite counter electrode composed of platinum nanoparticles (Pt NPs), activated carbon (AC), and Sri Lankan vein graphite (GR) was developed. The composition of AC:GR:PtNPs composite counter electrode used was 0.50 g of AC, 0.50 g of GR, and 1.00 mL of 1.0 mM of the solution prepared by dispersing 8.19 µL of H_2PtCl_4 in 1.00 mL of ethanol. To study the effect of sintering temperature, CEs were subjected to sintering at temperatures ranging from 250 °C to 500 °C at 50 °C intervals, each for 30 min. The highest efficiency of 5.09% was achieved under the irradiance of 100 mW cm^{-2} (AM 1.5), with the composite CEs compared to the 6.54% efficiency of the DSCs made with Pt sputtered CE. Electrochemical impedance spectroscopic and cyclic voltammetric analyses of the CE at the optimum sintered temperature of 400 °C showed enhanced electro-catalytic activity, reduced charge transfer resistance, and improved electrochemical stability.

Keywords: Composite counter electrode, Dye-sensitized solar cells, Platinum nanoparticles, Sri Lankan vein graphite