Anurag Roy et al., Int J Mater Sci Res. 2019
DOI: http://dx.doi.org/10.18689/2638-1559.a3.004

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3rd International Conference on

MATERIALS SCIENCE AND RESEARCH

November 28-29, 2019 | Kuala Lumpur, Malaysia

Carbon Materials for Third Generation Solar Cells

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Recently organic-inorganic metal halide perovskite solar cells represent a major breakthrough in the development of photovoltaic sector. Though several major factors such as stability, cost, materials, fabrication and efficiency become the consequential factors to control the performance of the solar cells. There is an intriguing riddle to understand how to construct a stable system in order to get the maximum efficiency. Much progress has been already made in the stability of the halide perovskite. Nevertheless, the underlying mechanism of the degradation and performance assessment remains far from being comprehensively understood. Many of these issues can be addressed using new, carbon-based nanomaterials. Carbon nanomaterials such as carbon nanotubes, graphene, fullerene, graphene quantum dots etc. display remarkable electrical, thermal and mechanical properties that enable several exciting applications in solar cell application. Besides, their self-assembling characteristics allow these carbon nanomaterials to be readily explored to be a low-cost and efficient solar light harvesting materials. We report here fully printable carbon solar cells exhibits a maximum power conversion efficiency of ~2.89% under 1 SUN 1.5 AM. Sequential fabrication of carbon solar cells was performed under ambient condition with FTO/graphene/SWCNT/C60/Carbon paste layers and on the top employed Poly(methyl methacrylate) coating without employing hole transport material. The resulting PSCs exhibits quite impressive stability up to 7 days on introduce of the PMMA coating. Through this effort, the results envisage to deliver carbon solar cell insights that are less explored, cheaper, efficient and reliable. Development of carbon based material develops an efficient replacement of the Pt-free counter electrode material which can make DSSCs more competitive among various photovoltaic devices. Significant results of various carbon counter electrodes was further extracted with one of the major leading alternative photoanodes such $BaSnO_3$ (BSO). The natural source derived carbon material series, 3.81% (GCP) and 3.27% (GCS) efficiencies were observed for BSO based DSSC.

Biography

Dr. Anurag Roy, native from West Bengal, India. He did B.Sc. (Chemistry) from University of Calcutta, India in 2011 followed by M.Sc. (Chemistry) from Indian Institute of Technology (Indian School of Mines), Dhanbad, India in 2013 followed by PhD (Chemistry) from CSIR-Central Glass and Ceramic Research Institute, Kolkata, India in 2019. Presently, he is working as a Post-doctoral research associate in University of Exeter, United Kingdom. He is a gold medalist in M.Sc. securing highest marks in my batch. He got DST-INSPIRE fellowship from Department of Science and Technology, Government of India to persue my PhD. He is lifetime member of Material Research Society of India, DNA Society of India and Indian Science Congress Association. His research interest belongs to studies on various materials in energy harvesting sector. This includes synthesis, physico-chemical characterization and application aspects. He received Newton-Bhabha fellowship from British Council in 2017 and also selected as an affiliated member in International Union of Pure Science and Applied Chemistry (IUPAC) in 2018. He has published 17 international SCI research publications and won 3 best poster awards. He already presented 6 oral presentations in national and international conferences.