Title: Development of Polymer Solar Cells using Graphene/Transition Metal Dichalcogenite 2D Materials as Ternary additives

Kusum Kumari, Assistant Professor, Department of Physics, National Institute of Technology Warangal, Warangal-506004, INDIA

Abstract:

Solar cells are among the most promising technologies for renewable clean energy. However, conventional silicon-based solar cells are too expensive for everyday use. Organic Photovoltaic(OPV) devices have shown great promise due to the advantages of low cost, flexibility, light-weight, easy processing etc. The current state of- the-art laboratory efficiency is 10-11%. These improvements are mainly attributed to the development of new materials and device engineering, including non-fullerene acceptor, morphology control, interfacial engineering. Despite those achievements, many issues related to efficiency and lifetime remains that need to be addressed before OPVs are practically utilized.

Recently, ternary polymer solar cell(PSC) blends have been explored as a strategy to improve OPV performance; however, this approach has been demonstrated only for polymer–fullerene solar cells with organic ternary additives and has not yet addressed stability issues. Here, we will present the PSCs comprising ternary blends of semiconducting polymers, PCBM acceptor, and 2D materials Graphene Oxide(GO)/ Transition Metal Dichalcogenite(TMD) as third component additives. 2D materials have recently been explored in OPV owing to their high carrier mobilities, high chemical stability, and exceptional charge transport properties. We found that the addition of GO and TMD nanosheets in polymer-fullerene blends as third composnent additive improves performance and photo stability of such OPV devices. This is attributed to the fact that GO nanosheets reduces recombination by increasing holes and electrons separation in donor-acceptor blend via cascade charge transfer mechanism, and also aids the efficient charge transport through the blend matrix as they contribute to high carrier mobilities. Besides, the addition of TMD nanosheets as additives in ternary blends provides extra advantage of complementary optical absorption in the visible and infrared. Therefore, the utilization of GO and TMD nanosheets as ternary additives in OPV creates new opportunities for the development of OPVs.

Image:

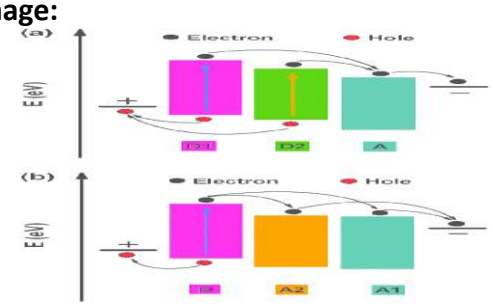


Fig. Schematic showing cascade charge transfer in ternary blends

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Biography:

Kusum Kumari has completed her PhD at the age of 30 years from Indian Institute of Technology Delhi, New Delhi, India and postdoctoral studies from Technical University Chemnitz, Germany, and Ulsan National Institute of Science and Technology, Ulsan, South Korea. She is Assistant Professor at Department of Physics, National Institute of Technology Warangal, a premier Technical Institute of India. She has expertise in synthesis of nanomaterials, thin films and development of 2D materials, and fabrication of organic photovoltaic devices. Her major scientific contributions include studies on charge transport and photo-physical properties of hybrid polymer-nanocrystal composites for polymer solar cells. She has published arould 10 papers in reputed international journals and presently working on two R&D projects on "Perovskite Solar Cells" funded by Department of Science and Technology, Govt. of India.

Email: kusumiitd@gmail.com