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Enhanced light harvesting and conversion efficiency by plasmonic Ag nanoparticles incorporated in organic photovoltaics

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Abstract content
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Energy harvesting by photovoltaic (PV) solar cells is a promising technology for future energy requirements. In the energy harvesting process, organic PVs (OPVs) show promising potential because of their capability to be incorporated with various nanomaterials in a cost effective way when compared to present day inorganic based PVs. The main bottle-neck for OPVs are to achieve higher power conversion efficiency (PCEs), which is a trade-off between the amount of light absorption, efficient photo-generation of electrons/holes and their charge transport to the respective electrodes. To overcome these difficulties nanoplasmonics has emerged recently as a new frontier in OPV research [1]. Noble metal nanostructures that can concentrate, scatter and guide light have demonstrated great capability for dramatically improving the PCE.
In the present study Ag nanoparticles are incorporated with hole transport layer (HTL). Here, commercially available PEDOT: PSS and as synthesized reduced graphene oxide (rGO) are used as HTL for OPV devices. Plasmonic absorption of Ag nanoparticles are studied by UV-Vis spectroscopy. The absorption wavelength was found to be tuned by size, coverage and geometry of the Ag nanoparticles. To demonstrate the effect of plasmonics in OPVs, a photoactive layer (P3HT:PCBM blend) has been spin coated on HTL layer followed by thermally evaporated Al electrode. The device properties are analysed by J-V measurements and the results are discussed with evaluated parameters and compared against a pristine device.

Reference
[1] M. Gu, Z. Ouyang, B. Jia, Nicholas Stokes et al., Nanophotonics 1 (2012) 235

Apply to be
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   award (Yes / No)?

No

Level for award
 (Hons, MSc,
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PhD

Main supervisor (name and email)
and his / her institution

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