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Solution-processed reduced graphene-based electrodes for organic photovoltaics

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Abstract: Since the isolation of free standing graphene in 2004, graphene research has experienced a phenomenal growth.[1,2,3] Due to its exceptional electronic, optical and mechanical properties, it is believed to be the next wonder material for optoelectronics. The enhanced electrical conductivity, combined with its high transparency in visible and near-infrared spectra, enabled graphene to be an ideal low cost indium-tin oxide (ITO) substitute. Solution-processed graphene combines the unique optoelectrical properties of graphene with large area deposition and flexible substrates rendering it compatible with roll-to-roll manufacturing methods. This work provides an overview of recent research progress in the application and consequent physical-chemical properties of solution-processed graphene-based films as transparent conductive electrodes (TCEs) in organic photovoltaic (OPV) cells.[4] Reduced graphene oxide (rGO) can be effectively utilized as the TCE in flexible OPVs, where the brittle and expensive ITO is incompatible.

Special attention is paid to the preparation of solution processable reduced graphene oxide micromesh (rGOMM) electrodes, using a laser-based patterning technique.[5] This compatible with flexible, temperature sensitive substrates method allows to accurately control and enhance the electrode transparency, with a subsequent slight increase in the sheet resistance, and therefore improve the tradeoff between transparency and conductivity of reduced graphene oxide (rGO) layers. In addition, the effect of rGO flakes decoration with metal NPs (Au, Ag) on the sheet resistance and the transparency of rGO and rGOMM electrodes is also investigated. It is likely that the fabrication of mesh will increase the TCE transparency and at the same time the incorporation of metal NPs will boost its conductivity compared to pure rGO micromesh.

References

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