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Flexible Organic Optoelectronic Devices Based on Graphene Transparent Conductive Electrodes

High electrical conductivity, optical transmittance, mechanical flexibility, chemical stability and the successful synthesis of large-area graphene film have led to a growing interest in its application for flexible organic optoelectronic devices such as organic photovoltaic (OPV) cells and organic light emitting diodes (OLEDs), as an alternative to indium tin oxide (ITO) as the transparent conductive electrodes (TCEs).[1] However, high sheet resistance, low work function, large surface roughness and poor interfacial compatibility seriously limit its application. Here, a single layer graphene (SLG) is proposed as transparent anodes for OPV cells using molybdenum oxide (MoOx) as an interfacial layer to simultaneously increase the work function and conductivity of SLG. The resulting cells have a power conversion efficiency only 17.6% lower than the cells with equivalent structure but prepared on ITO anodes. [2] A graphene oxide/graphene (GO/G) vertical heterostructure TCE having greatly improved optical transmittance, a large work function, high stability, and good compatibility with MoOx layer is designed. OLEDs based on such GO/G heterostructure TCEs show much higher efficiency than those based on ITO anodes. [3] Furthermore, a natural organic small molecular-assisted wet etching transfer method is developed to fabricate a clean and damage-free graphene TCE with a root-mean-square surface roughness as low as 3.51 nm. A 4-inch flexible green OLED with uniform light emitting and high luminance (ca. 10000 cd m^{-2} at 16 V) has been successfully fabricated for the first time, showing a strong potential of graphene TCEs for next generation flexible optoelectronics. [4]

References

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