Application of Graphene in Bulk Heterojunction Hybrid Solar Cells and Efficient Stable Perovskite Solar Cells

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Herein, we employed reduced graphene oxide (rGO) based composite as p-type charge carrier and diffusion barrier in both bulk heterojunction hybrid solar cells and efficient stable perovskite solar cells. Ag-rGO composite showed p-type behavior with mobility of 3.3x105 cm2V-1s-1 and conductivity of 9x106 S/m which is one-order of magnitude greater than pristine graphene (i.e., 1.59x105 S/m). The power conversion efficiency of the hybrid organic solar cells improved 42% due to an enhanced charge carrier generation and fast extraction to the electrode. Moreover, in perovskite solar cells, the rGO composite not only profited as charge carriers and diffusion barrier but also assisted to suppress the field-assisted ion migration and prevent photochemical degradation. We utilized thermal aging process to stimulate ion migration in perovskite and observed the performance of solar cells with rGO composite were stable over 90% of their initial values while the efficiency of pristine perovskite cells dropped to 39% of initial values due to degradation.