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Improving the performance of All-Polymer Solar Cells YAN JIN, FEI YU, VIKRAM KUPPA, Univ of Cincinnati — We find that the power conversion efficiency (PCE) of photovoltaic devices based on conjugated polymer blends is dramatically improved by the addition of small quantities of pristine -unmodified- graphene in the active layer. The graphene is obtained by solvent exfoliation from graphite, and is spin-coated along with the conjugated polymer blend from solution to make cells. The PCE as well as short circuit current (Jsc) show an approximately three-fold increase with increasing graphene concentration. The incorporation of graphene changes the recombination mechanism in such cells from monomolecular (geminate) to bimolecular (non-geminate) recombination, as revealed from current-light intensity studies. In contrast to neat devices, the addition of graphene leads to an increase in the thickness of the active layer, which also influences performance. These investigations reveal three major effects of graphene on polymer blend solar cells: the incorporation of graphene (i) enhances exciton dissociation, (ii) increases the charge transport, and (iii) modifies the polymer morphology. The results demonstrate the potential for graphene in improving OPV performance by addressing poor charge mobilities, which are a fundamental drawback of OPV cells.

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