Solid additive incorporated photoactive blend system for high efficiency polymer solar cells

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In an effort to fine tune/control the optimal morphology, various solvent additives (such as 1,8-dioodoctane, chloronapthalene, nitrobenzene etc) have been used on the bulk heterojunction photoactive blend [1]. In this work, we utilized a new solid additive (2,3-dihydroxypyridine) blended into the poly(3-hexylthiopene) (P3HT) and Indene-C60 bisadduct (ICBA) to modulate the overall photovoltaic (PV) characteristics. The additive casted blend film exhibited superior characteristics than that of the pristine P3HT:ICBA (blend) film casted from dichlorobenzene. The better device characteristics for additive included blend film arises from the enhanced light absorption capability, better self-ordering, improved crystalline nature, hole mobility and suitable morphology [2][3]. Atomic force microscopy (AFM) images revealed the better interpenetrated fibrous morphology which may be beneficial for the nanoscale phase separation leading to a balanced charge transport than the pristine blend film. AFM images also showed that the possible presence of fullerene (ICBA) rich domain on the top after the inclusion of additive. Several other physico-chemical characterizations were also evaluated. **Fig.1** presents the photocurrent density-voltage (J-V) curves for the pristine and additive casted blend devices. The optimized additive casted blend device exhibited a power conversion efficiency (PCE) of 4.63 %, with open circuit voltage of 0.84 V, short-circuit of 8.71 mA/cm^2, and fill-factor of 0.63, whereas the pristine device showed only a PCE of 3.95%. It is expected that the additive casted blend film will remain air stable for a longer time than the pristine device.

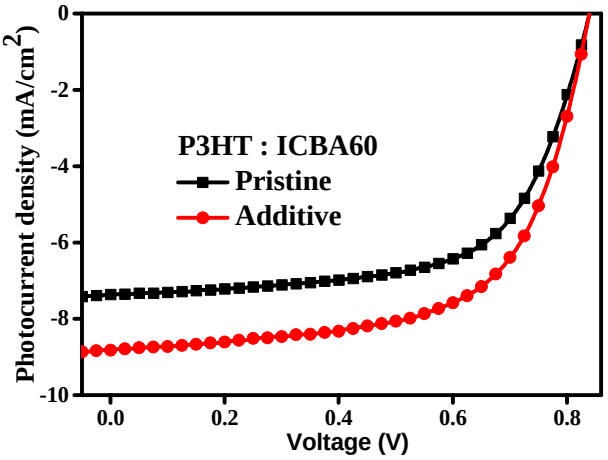

Fig. 1. J-V curves for the pristine and additive casted blend devices

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