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ORGANIC PHOTOVOLTAIC CELL: A PROMISING INDOOR LIGHT HARVESTER FOR SELF-SUSTAINABLE ELECTRONICS

Wing Chung Tsoi
Swansea University, UK

Photovoltaic cells are attracting significant interest for harvesting indoor light for low power consumption wireless electronics such as those required for smart homes and offices, and the rapidly-growing Internet of Things. Here, we explore the potential of solution processable, small molecule photovoltaic cells as indoor power sources. By optimizing solvent vapour annealing (SVA) time to the photovoltaic layer, a balance between its crystallization and phase separation is obtained, resulting in a record power conversion efficiency of over 28% under fluorescent lamps of 1000 lux, generating a maximum power density of 78.2 μW/cm2 (>10% efficiency under AM1.5G). This high indoor performance surpasses silicon based photovoltaic cells, and is similar to gallium arsenide photovoltaic cells. Besides, the ratios of the voltage at maximum power point to the open circuit voltage are similar from indoor lighting to one sun condition, which is unique and allows a less power consuming method to track the maximum power point for a broad range of light intensities (potentially attractive for wearable PV). New insight on the effect of SVA to the indoor and one sun performance is provided by advanced optoelectronic characterization techniques, which shows that the mobility-lifetime products as a function of charge carrier density can be correlated well to the performance at different light levels. Our results suggest that organic photovoltaic cell could be promising as indoor power source for self-sustainable electronics.

w.c.tsoi@swansea.ac.uk