Ying-Chieh Chao et al., J Material Sci Eng 2016, 5:10(Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.055

Enhanced thermal stability of organic photovoltaics via incorporating triphenylamine derivatives as additives

Ying-Chieh Chao, Chia-Hsin Chuang, Hsiang-Lin Hsu, Hsing-Ju Wang, You-Chi Hsu, Chih-Ping Chen and **Ru-Jong Jeng**
National Taiwan University, Taiwan

In this work, we prepared four star-shaped conjugated small molecules, the triphenylamine dithiophene (TBT) derivatives, namely TBT-H, TBT-Br, TBT-OH and TBT-N_3 presenting hydride, bromide, hydroxyl and azide terminal functional groups, respectively. These TBT derivatives were used as additives in the active layers of organic photovoltaics to investigate the effect of intermolecular interactions (TBT-H, TBT-OH) or cross-linking (TBT-N_3, TBT-Br) on the long-term thermal stability of the devices. From analyses of blend film morphologies and optoelectronic and device performance, we observed significant enhancements in thermal stability during accelerated heating tests at 150°C for the devices incorporated with the additives TBT-N_3 and TBT-Br. These two additives functioned as cross-linkers and constructed local borders that effectively impeded heat-promoted fullerene aggregation, thereby leading to highly stable morphologies. When compared with corresponding normal devices, the TBT-N_3-derived devices based on poly(3-hexylthiophene) exhibited greater stability with the power conversion efficiency (PCE) remaining as high as 2.5% after 144 hours at 150°C. Because of this enhancement, a device based on an amorphous low-band gap polymer, namely poly(thieno[3,4-b] thiophene-alt-benzodithiophene) with the addition of TBT-N_3 was fabricated. We observed a significant improvement in device stability, retaining approximately 60% (from 5.0 to 3.3%) of its initial PCE under accelerated heating (150°C). In contrast, the PCE of the corresponding normal device decayed to 0.01% of its initial value.

Biography

Ying-Chieh Chao is currently pursuing his PhD at National Taiwan University, Taipei, Taiwan. His main research focuses on organic conjugated polymers and organic photovoltaics. He has developed a cross-linking system to efficiently maintain the thermal stability of organic photovoltaics. He is also a Lecturer at Department of Materials Engineering, Ming Chi University of Technology, New Taipei City, Taiwan.

d02549003@ntu.edu.tw

Notes: