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Solution phase photodegradation studies of PCDTBT

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Poly[N-9'-heptadecanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3'-benzothiadiazole)], PCDTBT, is a conjugated donor polymer used in low bandgap organic solar cells (OSCs). OSC efficiencies decrease when exposed to light, oxygen, or water. The effects of various excessive light conditions on degrading dilute PCDTBT in solution are investigated in this work. A custom photodegradation fluorescence spectrometer setup was constructed to rapidly photodegrade PCDTBT solutions with a chosen laser intensity and wavelength. Changes in the recorded fluorescence spectra reflect structural polymeric changes induced by the high intensity laser irradiation. This, combined with the steady state absorption profile before and after 3 hours of continuous photodegradation, confirms that chain scission (bond breaking) occurs. Extracted fluorescence intensity decay rates suggest rapid initial degradation within the first 30 minutes followed by a much slower degradation regime. Other structural information is also gained, including chain length distributions and the degree to which conformational rearrangement of the polymer backbone plays a role during degradation. These findings indicate that this type of constructed laser fluorescence spectrometer setup is a valuable spectroscopic tool which could be of use to the OSC community for studying photodegradation dynamics. Importantly it allows for isolating and comparing the effects of different excitation intensities and wavelengths on photodegradation which cannot be straightforwardly done with currently ubiquitous broad-band solar simulators.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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