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Thermal stability of diketopyrrolopyrrole-based terpolymers with tunable broad band absorption for polymer solar cells.

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Organic solar cell (OSC) research has advanced significantly during the past few years with the introduction of new polymers. The molecular engineering of terpolymers has enabled easy morphological control in binary devices over ternary blends and power conversion efficiencies (PCEs) exceeding 18% have been recorded. However, in contrast to photovoltaics based on inorganic semiconductors such as silicon, OSCs degrade during illumination and in the dark. In this regard, we examined the thermal stability of a series of terpolymers comprising one electron donor and two types of electron acceptors, blended with $PC_{71}BM$. The terpolymers exhibited very broad absorption spanning from 300 to 900 nm, illustrating the success of the terpolymer approach. The absorption spectra were blue-shifted with increasing temperature, suggesting a decrease in the conjugation length of the polymers. The photoluminescence yield also increased with the temperature. Thin films of the terpolymers blended with $PC_{71}BM$ were degraded at 85 ℃ and characterized as a prospective active layer for OSCs by absorption, photoluminescence, AFM, TEM, Raman, and time-correlated single-photon counting (TCSPC). The fresh films displayed a PCE of 5.7% with a short-circuit current density of 15.2 mA/cm^2, indicating good complementarity in the absorption of the donor and acceptor materials. A comparative analysis of key features of the absorption and photoluminescence spectra in association with the morphological characterization results served as an indicator of the thermal stability of the structural and photo-physical properties of the terpolymers.

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

Yes

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

PhD

Primary authors: Mr NCHINDA, Leonato Tambua (Department of Physics, University of Pretoria, South Africa.); Dr TEGEGE, Newayemedhin A. (Department of Physics, Addis Ababa University, Ethiopia.); Prof. KRUGER, Tjaart P.J. (Department of Physics, University of Pretoria, South Africa.)

Presenter: Mr NCHINDA, Leonato Tambua (Department of Physics, University of Pretoria, South Africa.)

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