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Time-dependent efficiency measurements of donor-acceptor, dye-sensitized polymer solar cells. KYLE BANDACCARI, GRACE CHESMORE, PARISA TAJALLI-TEHRANI VALVERDE, MITCHEL BUGAJ, BRIAN MCNELIS, RICHARD BARBER, JR., Santa Clara University — The fullerene/polymer active layer pairing of PCBM/P3HT has become the model system within the field of polymer solar cell research. A large body of work concerned with reporting improved efficiencies for this system exists, but truly quantitative studies of device lifetime and long-term degradation tendencies are much rarer. Here, we report the effects of two donor-acceptor diazo dye sensitizers on efficiency and lifetime upon addition into the PCBM/P3HT active layer at varied concentrations. The electrical and efficiency measurements were supplemented by time-dependent UV-visible spectroscopy studies and morphology investigations via atomic-force microscopy (AFM). This pairing with spectroscopy offers an internal check on the data as the rate of change in absorbance of the active layer correlates almost exactly to the rate of power conversion efficiency decrease. Additionally, AFM imaging reveals different morphology patterns when dye concentrations and functionalities change. Such observations suggest that such small-molecule sensitizers exert yet undetermined effects on the organization of components within the active layer at the molecular level.

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