Stability and degradation of organic photovoltaics fabricated, aged, and characterized by the ISOS 3 inter-laboratory collaboration - DTU Orbit (17/12/2018)

Seven distinct sets (n > 12) of state of the art organic photovoltaic devices were prepared by leading research laboratories in a collaboration planned at the Third International Summit on Organic Photovoltaic Stability (ISOS-3). All devices were shipped to DTU and characterized simultaneously up to 1830 h in accordance with established ISOS-3 protocols under three distinct illumination conditions: accelerated full sun simulation; low level indoor fluorescent lighting; and dark storage with daily measurement under full sun simulation. Three nominally identical devices were used in each experiment both to provide an assessment of the homogeneity of the samples and to distribute samples for a variety of post soaking analytical measurements at six distinct laboratories enabling comparison at various stages in the degradation of the devices. Characterization includes current-voltage curves, light beam induced current (LBIC) imaging, dark lock-in thermography (DLIT), photoluminescence (PL), electroluminescence (EL), in situ incident photon-to-electron conversion efficiency (IPCE), time of flight secondary ion mass spectrometry (TOF-SIMS), cross sectional electron microscopy (SEM), UV visible spectroscopy, fluorescence microscopy, and atomic force microscopy (AFM). Over 100 devices with more than 300 cells were used in the study. We present here design of the device sets, results both on individual devices and uniformity of device sets from the wide range of characterization methods applied at different stages of aging under the three illumination conditions. We will discuss how these data can help elucidate the degradation mechanisms as well as the benefits and challenges associated with the unprecedented size of the collaboration.

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