Stability of scalable organic photovoltaics for indoor and transparent applications

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The Power Conversion Efficiency (PCE) of Organic Photovoltaics (OPV) has recently crossed the 20% milestone, placing an even larger focus on module scale-up, as well as on device degradation and stability. In this presentation, recent work on scalable OPV will be presented, having a focus on Roll-to-Roll (R2R) techniques for scalable module development at ambient conditions [1,2]. We demonstrate ambient air slot-die coated OPV devices reaching above 15% PCE on cell and 13% PCE on module level, as well as a new device architecture facilitating >13% PCE for ITO-free devices manufactured using solely R2R processing techniques. Stability assessment is done using ISOS protocols to shed light on the degradation processes taking place in the OPV cells and modules. The results point at interface related degradation being dominant in these OPV devices, and degradation mechanisms taking place at device interlayers will here be discussed in more details. Finally, application routes in terms of transparent photovoltaic (TPV) and indoor OPV devices will be presented and discussed. This also includes activities on design and integration of photon light management stacks to enhance the performance of (semi-transparent) OPV modules further.

1. *E. Jayaraman, et. al. Adv. Energy Mater., e04465 (2025)*
2. *E. Jayaraman, et. al. APL Energy, 3, 036101 (2025)*