Organic photovoltaics with 30-year lifetimes for power generating windows

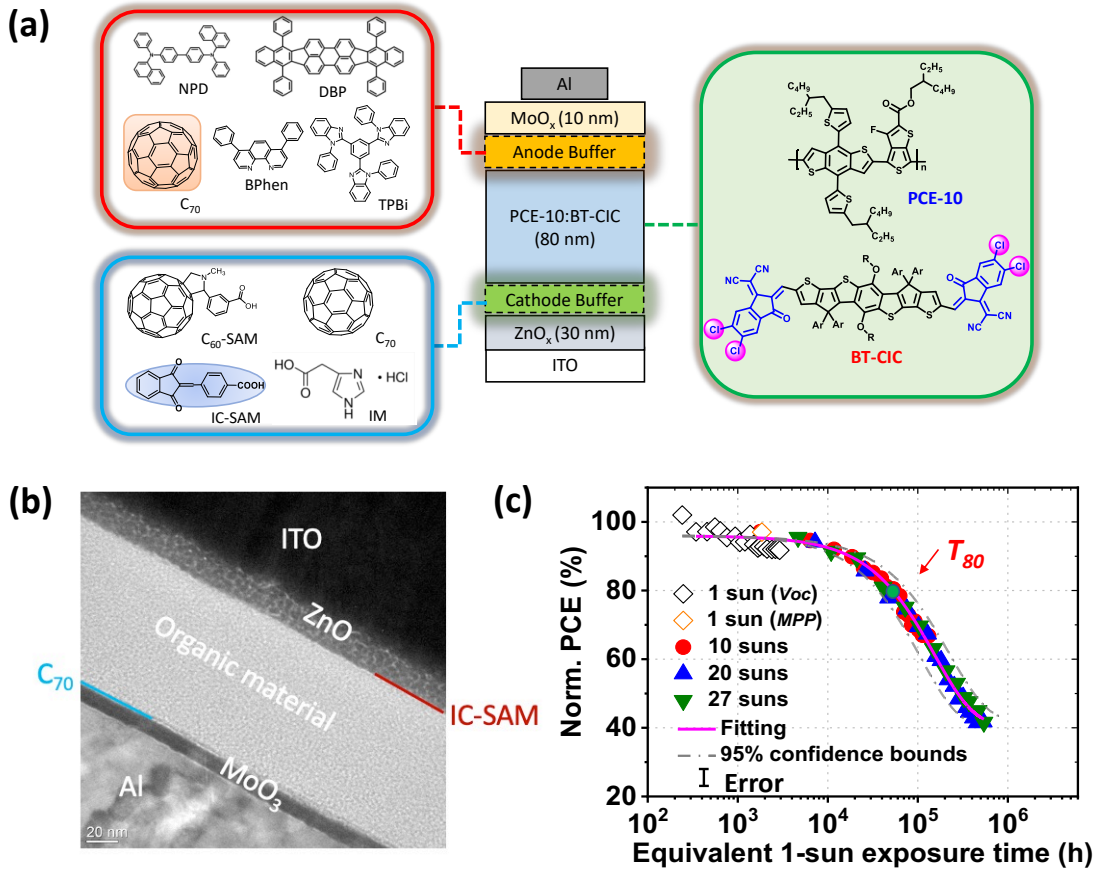

Figure: (a) Schematic of the device showing layer thicknesses and compositions (right): molecular structural formulae of the PCE-10 and BT-CIC (left): molecular structural formulae of the cathode and anode buffer materials. (b) Transmission electron microscope image of a cross-sectional slice of an aged OPV with the IC-SAM and C_{70} between the organic material and the external buffers. (c) Normalized PCE plotted vs. the equivalent 1-sun exposure time for OPV cells under all illumination conditions.

Objective

- To develop a new transparency-friendly solar cell design that can marry high efficiencies and low potential fabrication cost with long operational lifetime

Impact

Organic photovoltaic cells (OPVs) have the potential of becoming a productive renewable energy technology if the requirements of low cost, high efficiency and prolonged lifetime are simultaneously fulfilled. Since the efficiencies of OPVs have already reached 18% through the development of non-fullerene acceptors (NFAs), and production costs have been estimated to be competitive with incumbent solar technologies, the remaining unfulfilled promise of this technology is its inadequate operational lifetime. Here, we demonstrate that the instability of NFA solar cells arises primarily from chemical changes at organic/inorganic interfaces bounding the bulk heterojunction active region. Encapsulated devices are stabilized by additional protective buffer layers between the active region and charge transporting layers, as well as the integration of a simple solution processed ultraviolet filtering layer to the distal surface of the glass substrate, leading to a 30-year extrapolated device lifetime.

Reference

- Y Li, et al., *Nature Communications*, DOI: 10.1038/s41467-021-25718-w (2021)

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