Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Contorted hexabenzocoronene derivatives enable fullerene-free, semi-transparent solar cells with record-breaking single-junction photovoltage NICHOLAS DAVY, MELDA SEZEN, YUEH-LIN LOO, Department of Chemical and Biological Engineering, Princeton University — Recent work on tuning the chemical structure of contorted hexabenzocoronene (cHBC) in our group has yielded derivatives with a spectrum of energy levels and absorption profiles, greatly improving the utility of these materials as donor and/or acceptor constituents in organic solar cells. Here, we report planar-heterojunction solar cells comprising an extended heterocyclic cHBC donor and a halogenated cHBC acceptor. By harvesting primarily near-UV light, these devices exhibit a record open-circuit voltage of 1.5 V; this value is higher than any previously reported value for a single-junction organic solar cell. Our active layers are molecularly smooth and pinhole-free; these devices should be scalable to large areas without incurring substantial loss to performance. With a transmittance of 79% across the visible, our devices can be vertically integrated to directly drive the switching of electrochromic windows, where existing prototypes depend on tandem solar cells having near-infrared absorbers.

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Date submitted: 05 Nov 2015 Electronic form version 1.4