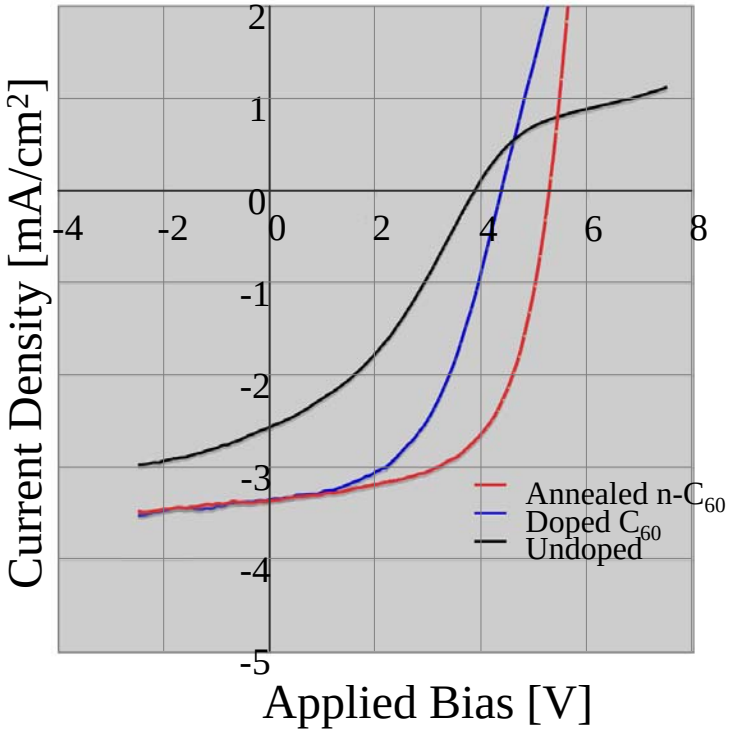
IRG3: Chemical Doping of Organic Molecular Films for Photovoltaic Applications (DMR-0213706)

Calvin Chan, Wei Zhao, and Antoine Kahn (Princeton)
Stephen Barlow and Seth Marder (Georgia Tech)

To advance the application of organic molecular films in solar cells, PCCM researchers have improved their conductivity and carrier injection by n-doping the acceptor layer in a donor-acceptor cell. The acceptor was a fullerene layer, C_{60}, while the dopant was the low-ionization-energy molecule decamethylcobaltocene ($CoCp_2^*$). Simple ITO/CuPc/ C_{60}:$CoCp_2^*$/Ag devices were constructed, and exhibited increased short-circuit currents (J_{sc}), open-circuit voltages (V_{oc}), and fill factors (FF), and *doubled* power conversion efficiency compared with analogous undoped devices. These very significant improvements reflect increased film conductivity, resulting in decreased series resistance as well as changes in electric-field distribution and built-in voltage of the device that assist in carrier extraction.



J-V curves for the illuminated ITO/CuPc/ C_{60}:$CoCp_2^*$/Ag cell. Black curve: undoped C_{60}; Blue and red curves: doped C_{60} before and after annealing. The fill factor for the red curve is 0.60.

Reference: C.K. Chan, W. Zhao, S. Barlow, S.R. Marder, and A. Kahn, "Decamethylcobaltocene as an efficient n-dopant in organic electronic materials and devices", *Org. Electron.*, **9**, 575 -581(2008).