Organic solar cells based on interfaces between electron donor and electron acceptor molecules have incident-photon-to-extracted-charge conversion yields of over 85%, and absorbed photon-to-extracted-charge conversion yields of 90-100%. Their power conversion efficiency is currently limited by their low operating voltage, as compared to the optical gap of the main absorber material, indicating large energy losses per absorbed photon. We explore possibilities for increasing the operating voltage and discuss the influence of the donor-acceptor interfacial area, electronic coupling and molecular reorganization. Charge transfer (CT) states at the donor-acceptor interface play hereby an important role. These states have interesting fundamental properties which will be exploited to enable narrow band, near-IR photo-detection. This new type of photodetector competes in the near-infrared (NIR) wavelength range with standard organic photodetectors but extends their detection range to longer wavelengths.
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