New Materials for Printed Organic Solar Cells

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In this presentation we will report the molecular design by DFT computations, synthesis, and molecular and structural characterization of new molecular building blocks and polymeric materials for organic photovoltaic cells. We have now families of polymer donor-polymer acceptor semiconductors achieving PCEs ~7% and polymeric donor-fullerene blends with efficiencies surpassing 10% in inverted architectures. New donor-acceptor polymers achieving exceptionally large fill factors (~ 80) based on BTI cores, very V_{oc} (>0.9 V) based on the isoDPP core, and new bezothiadiazole-based polymers with combined large current and voltage will also be presented. Furthermore, we will show recent studies on device performance achieved upon ambient processing and lifetime stability test under light soaking. We report results on metal oxide blends with tuned workfunction to replace conventional spin-coated materials enabling improved performance or enable new functions. Finally, we demonstrate a module and recorded PCE>4% with active area >20cm^2 using slot die coating. Our results demonstrate that single-junction OPV cell with efficiencies >10% for commercial formulations are possible and that all-polymer blend cells can also compete with polymer-fullerene devices.

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