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Pi-Conjugated Dendrimers for Organic Photovoltaics SEAN SHAHEEN, WILLIAM MITCHELL, NIKOS KOPIDAKIS, JOSEPH BOZELL, GARRY RUMBLES, National Renewable Energy Lab — Polymer-based organic photovoltaic (OPV) devices are promising candidates for low-cost solar cell fabrication. The operation of such devices is known to be strongly dependent upon the morphology and carrier mobility of the polymer. Here we discuss the use of pi-conjugated dendrimers in OPV devices. Dendrimers have a precisely defined molecular weight, in contrast to pi-conjugated polymers, which leads to a well-defined morphology. This morphology can be highly ordered owing to strong pi-electron interactions between dendrimers. We have synthesized a family of phenyl-cored thiophene dendrimers with a variable number of arms and a variable number of thiophenes in each arm. The optical band gaps of these materials in thin film form range from 2.3 to 2.6 eV. Time-resolved microwave conductivity measurements of the dendrimers showed a power-law dependence of lifetimes extending into the millisecond regime, indicative of a very pure material. Preliminary OPV devices fabricated by blending the dendrimers with a soluble fullerene yielded maximum open-circuit-voltages of 900 mV and external quantum efficiencies of 22%. A reduced band gap dendrimer was also synthesized by adding strong electron withdrawing groups onto the phenyl core, resulting in an optical band gap of 1.82 eV. This material shows good molecular ordering as evidenced by x-ray diffraction.

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