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Promoted Thermoelectric Properties of Polymers through Controlled Tie-Chain Incorporation

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Abstract : We have demonstrated a model system for the controlled incorporation of tie-chains into semicrystalline conjugated polymers using blends of different molecular weights that leads to a significant increase in electrical conductivity. Through careful assessment of the microstructural evolution upon tie chain incorporation we have demonstrated that no major changes in phase morphology or structural order in the crystalline domains occur and that the observed enhancement in electrical conductivity can only be explained consistently by tie chains facilitating the transport across grain boundaries between the crystalline domains. Here we studied the thermoelectric properties of aligned, ion exchange-doped ribbon phase PBTTT with blends of different molecular weight components. We demonstrate that in blended films higher electrical conductivities (up to 4810.1 S/cm), Seebeck coefficients and thermoelectric power factors of up to 172.6 μW m-1 K-2 can be achieved than in films with single component molecular weights. We investigate the underpinning thermoelectric transport physics, including structural and spectroscopic characterization, to better understand how controlled tie chain incorporation can be used to enhance the thermoelectric performance of aligned conjugated polymers.

Keywords : organic electronics, thermoelectrics, conjugated polymers, tie chain
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