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The Prospects of Organic Semiconductors for Thermoelectrics

MICHAEL CHABINYC, University of California Santa Barbara

Organic semiconductors have moved from a laboratory curiosity to commercial use in displays with organic light emitting diodes. In comparison to inorganic semiconductors, a remaining challenge for organic materials is the rational control of their electrical conductivity by doping. Due to the low lattice thermal conductivity of organic materials and their high electrical conductivities, organic semiconductors represent a promising class of solution processable thermoelectrics. The state of organic thermoelectrics and work from our lab on electrical doping of both p- and n- type semiconducting polymers will be discussed. The phase behavior of blends of semiconducting polymers and molecular dopants plays a critical role in their ultimate performance. Recent work on charge transfer doping and self-doping of polymers and molecular materials will be presented. Data mining from the literature along with results on recently developed materials systems suggests directions for optimization of organic thermoelectrics.