

Organic-based thermoelectrics: Where we are and what challenges we are facing

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ABSTRACT

Thermoelectric materials based on organic semiconductor compounds are considered a highly promising approach towards sustainable, cost- and energy-efficient recuperation of waste heat at moderate temperatures. First proof-of-concept devices have impressively confirmed this appraisal for p-type conducting polymers, showing thermoelectric figures of merit of up to $zT = 0.26$. However, fundamental challenges remain and need to be addressed in forthcoming research on this subject. In particular, the general improvement of the electrical conductivity, the implementation of air-stable n-type organic semiconductors as well as the abrogation of the mutual interrelation between the primary thermoelectric parameters constitute major objectives that need to be achieved for a successful application of organic materials in thermoelectric devices. For the case of strong donor-acceptor materials, in particular, the class of low-dimensional organic metals, I will illustrate how these requirements can be fulfilled and transferred to new thermoelectric materials.