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# High Thermoelectric Properties in Quasi-One-Dimensional Organic Crystals

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## Abstract

Recently, there has been a significant attention in thermoelectric (TE) applications of organic materials due to more diverse and tunable properties and less cost in comparison to inorganic counterparts. We present a short review about TE properties of organic materials and especially of quasi-one-dimensional (Q1D) organic crystals of p-type tetrathiotetracene-iodide,  $\text{TTT}_2\text{I}_3$ , and of n-type tetrathiotetracene-tetracyanoquinodimethane,  $\text{TTT}(\text{TCNQ})_2$ . To describe TE properties, we apply a physical model accounting for two of the most important electron-phonon interactions. One interaction is of deformation potential type and the other is of polaron type. The scattering of charge carriers on point-like impurities and on thermally activated defects is considered as well. It is shown that due to a partial compensation of above mentioned electron-phonon interactions, energy relaxation time of charge carriers increases significantly for a narrow strip of states in conduction band, with Lorentzian-type maximum as a function of charge carrier energy. The height of the maximum is limited by supplementary internal interactions and impurity scattering processes and may be rather high in sufficiently purified crystals. Charge carriers near this maximum will possess an increased mobility. If the concentration of charge carriers is optimized so as the Fermi energy is close to the states that correspond to this maximum, it is predicted to obtain high TE properties.