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THERMOELECTRIC PROPERTIES OF A THERMOELECTRIC MODULE MADE OF TTT2I3 AND TTT(TCNQ)2 ORGANIC CRYSTALS

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In this study, we conduct a comprehensive examination of the thermoelectric characteristics observed in crystals of TTT2I3 [1], which exhibit p-type behavior, and TTT(TCNQ)2 [2], functioning as an n-type conductor. These crystals have demonstrated adjustable thermoelectric properties by controlling the stoichiometry of charge carriers and impurity concentrations [3]. TTT2I3 crystals, structured with alternating layers of tetrathiotetracene and iodide, display effective charge transport along the primary crystallographic axis. Similarly, TTT(TCNQ)2 shares the layered architecture of TTT2I3 but with electron conductivity facilitated by TCNQ chains. In this investigation, we developed a theoretical model incorporating electron-phonon interactions and impurity scattering to analyze transport and thermoelectric characteristics. The kinetic equation is formulated utilizing two-particle retarded Green functions.

Numerical calculations were performed to assess electrical conductivity, Seebeck coefficient, thermoelectric power factor, and thermoelectric figure-of-merit, with consideration of charge carrier concentrations, temperatures, and impurity concentrations. This research enhances comprehension of organic thermoelectric materials and their prospective applications in sustainable energy contexts.

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