Low Temperature Thermoelectric Properties of Strongly Correlated Electron Materials TaS_2

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Strongly correlated electron materials have received much attention today as new-type of thermoelectric materials which are finding application in Peltier cooler *etc.* We have investigated experimentally the relation between strength of electron correlation and low temperature thermoelectric performance using layered compound 1T-TaS_2 as a test material. The 1T-TaS_2 shows a Mott transition with commensurate-incommensurate transition of charge-density-wave at about 180 K. The transition temperature *i. e.* strength of electron correlation can be controlled by doping of excess sulfur.
As lowering the temperature, in-plane electrical resistivity ρ and thermopower S increase abruptly at the Mott transition temperature; the transition temperature is changed from 160 K to 195 K depend on the amount of excess sulfur. The thermoelectric figure of merit $S^2\sigma/\kappa$ (κ: thermal conductivity) and power factor $S^2\sigma$ in the Mott insulator phase increase with increasing Mott transition temperature. It is due to the enhancement of thermopower in the mid-gap state of 1T-TaS_2. This is experimental evidence that the electron correlation (Coulomb repulsion) enhances thermoelectric performance in strongly correlated electron materials.

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