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Anharmonic phonons in type I clathrates KATSUMI TANIGAKI, JIAZHEN WU, HIDEKAZU SHIMOTANI, Tohoku University — A systematic study on the anharmonicity of phonons is made for thermoelectric single crystal type-I clathrates based on their heat capacity C_p at low temperatures (T) down to 360 mK. The low-T linear terms ${}^{obs}\gamma T$ of C_p, including the tunneling-term of the atoms accommodated in the host cages ($\gamma_{ph}T{=}\alpha T$), and the Sommerfeld itinerant-electron term ($\gamma_e T$) are successfully separated through careful measurements of sigle crystals with various carrier concentrations. The values of the density of anharmonic potentials are deduced. The effective mass (m$*$) enhancement is also determined from γ_e values and the electron-phonon interaction strength (λ) can be evaluated from these values. It is shown that both the thermal conductivities (κ's) and the electron-phonon interaction strengths (λ's) are quantitatively in good agreement with the α parameters deduced from the present experiments. The boson peaks observed at low energy excitations are disucssued in relation to the α values.

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