438.

Author

Kadlec, F (Kadlec, Filip); Kadlec, C (Kadlec, Christelle); Kuzel, P (Kuzel, Petr); Petzelt, J (Petzelt, Jan)

Title

Study of the ferroelectric phase transition in germanium telluride using time-domain terahertz spectroscopy

Source

PHYSICAL REVIEW B, vol.84, no.20, NOV 14 2011, 205209.

Abstract

Germanium telluride (GeTe) is a ferroelectric material presenting, at room temperature, both spontaneous polarization and electrical conductivity. Despite the simplicity of its crystal structure, the mechanism of the phase transition is still not well understood; the free charge carriers prevent the use of traditional spectroscopic techniques which could provide detailed information. While, for a long time, the transition was believed to be of displacive character, recent evidence suggests an order-disorder type. We report results of high-temperature measurements of GeTe thin films by means of terahertz spectroscopy showing the absence of critical phonon softening and revealing a low-frequency excitation in the paraelectric phase. We suggest two possible mechanisms which could be at the origin of this feature: either a critical relaxation related to the phase transition or hopping of free charge carriers. The former mechanism appears more probable due to the observed temperature evolution of the spectra. This indicates a mixed character of the phase transition; assuming a Curie-Weiss behavior, we deduce the value of the Curie-Weiss constant as C approximate to 1 x 10(5) K.