Invited lecture

Terahertz-band spectroscopy investigation of boson peak in glassy glucose

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Glassy materials show the boson peak (BP) at terahertz frequency region, which is a universal feature observed in specific heats, Raman scattering, and inelastic neutron scattering. Recently, we have pointed out that terahertz time-domain spectroscopy (THz-TDS) is suitable to detect the BP [1], although many recent researchers had been not aware that or forgotten the past far-infrared studies [1].

In the vibrational density of states spectrum g, the BP appears as a peak in the representation of g/ν² (ν: frequency) not in the g spectrum directly. Considering the relation of α = CIR·g (α: absorption coefficient, CIR: infrared light-vibration coupling coefficient) [2], the BP appear in the α/ν² representation in infrared spectrum, i.e. the BP is not a peak of the absorption spectrum, although it is a universal dynamic feature of glassy materials.

In this study, we demonstrate the THz-TDS on vitreous glucose which is hydrogen-bonded organic glass material. Fig. 1 shows boson peak representation α/ν² of vitreous glucose. The BP appears at around 1 THz clearly. Due to the relaxation process existing in low frequency region, the low frequency part of the each THz spectrum increases as temperature increases. We will compare the results with the low-frequency Raman scattering and low-temperature specific heat results.

![Fig. 1. Boson peak representation α/ν² of glassy glucose detected by THz-TDS.](image)

Keywords: Boson peak, terahertz time-domain spectroscopy, specific heat, glass, glucose

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References