Thermoelastic properties of liquid Bi determined by picosecond acoustics

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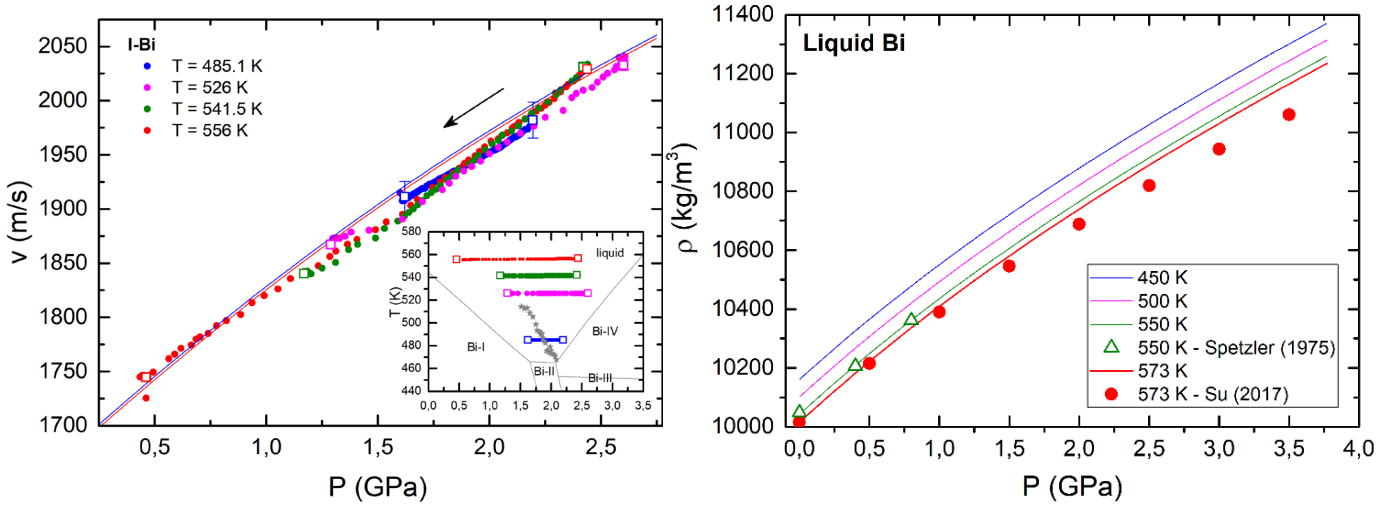
Abstract

Bismuth (Bi) has attracted considerable attention over the years due to its unique properties at high pressure and temperature. Among these, abnormal behaviour has been observed in the liquid state, possibly linked to a reversible liquid-liquid transition (LLT) [1]. To investigate this transition, picosecond acoustics measurements were performed on liquid Bi confined in diamond anvil cell [2, 3], up to 4 GPa and in the range of 450-600 K. Sound velocity measurements in the liquid state were extended in the metastable regime, several tens of K below the melting line. From these sound velocity data, we derived the equation of state of the liquid ρ(p,T) and other thermodynamic quantities such as the bulk modulus B_T or the isobaric specific heat C_p. Our experimental results reveal no significant anomalies in the thermo-elastic properties of liquid Bi across the investigated $p-T$ range. Specifically, our findings do not support the existence of a liquid-liquid structural transition, either above or below the melting line.



[1] M. Emuna *et al*, "A reversible transition in liquid Bi under pressure", *The Journal of Chemical Physics* **148**, 034505 (2018).

[2] S. Boccato *et al*, "Picosecond acoustics: a new way to access elastic properties of materials at pressure and temperature conditions of planetary interiors", *Physics and Chemistry of Minerals* **49**, 20 (2022).

[3] S. Ayrinhac *et al*, "Determination of indium melting curve at high pressure by picosecond Acoustics", *Phys. Rev. Materials* **6**, 063403 (2022).