

Title: Phase diagram and sound velocities of Galinstan measured by picosecond acoustics

Keywords: galinstan, liquid metal, phase diagram, sound velocities, picosecond acoustics technique, diamond anvil cell

Scientific description:

Galinstan, the commercial name for a ternary alloy system Ga-In-Sn, is a nontoxic liquid metal at ambient temperature, with a great technological interest (with many applications [1] in microfluidics, liquid metal ink, thermometry, radioelectric antennas, flexible/stretchable electronic systems, magnetohydrodynamics, etc). However, its physical properties (elastic and thermodynamic properties) are not well known. This is probably because of its difficult handling, due to the formation of a nanometric thin passivating oxide skin when the metal is exposed to air.

In this experimental work, we propose to determine the melting line of the liquid metal Galinstan (in the pressure range 0-20 GPa, and 300-600°C), and to measure the sound velocity by the picosecond acoustics technique combined with the resistive heated diamond anvil cell [2]. The sound velocity is measured through the analysis of patterns obtained by phonon surface imaging, or through the determination of the time-of-flight at a nanosecond time scale.

[1] *Can liquid metal flow in microchannels made of its own oxide skin?*, Liu, S., Sun, X., Kemme, N. *et al.*, *Microfluid Nanofluid* **20**, 3 (2016).

[2] *Thermodynamic properties of liquid gallium from picosecond acoustic velocity measurements*, S. Ayrinhac, M. Gauthier, G. Le Marchand, M. Morand, F. Bergame, and F. Decremps, *J. Phys.: Condens. Matter*, **27** 275103 (2015).

Techniques/methods in use: picosecond acoustics technique, diamond anvil cell

Applicant skills: experimentals

Industrial partnership: N

Internship supervisor(s) (name, email, phone, webmail): AYRINHAC Simon, 13-23/309, simon.ayrinhac@upmc.fr, +33(0)1-44-27-52-24

Internship location: IMPMC laboratory

Possibility for a Doctoral thesis: Y (specify if already financed)