

Collective Dynamics of Liquid Metals: from Simple to Extremely Non-Simple

Shinya Hosokawa, Faculty of Engineering, Hiroshima Institute of Technology, Japan. E-mail: hosokawa@cc.it-hiroshima.ac.jp

Recent developments in high-resolution inelastic X-ray scattering using third-generation synchrotron radiation facilities allow one to investigate the collective dynamics of a wide variety of liquid metals. The IXS studies have started from simple liquid metals such as the first experiment of liquid Li [1], Na, and Mg, and encompassed to several non-simple metals such as liquid Ga, Ge, and Si [2]. The experimental results revealed characteristic common features in the collective dynamics: 1) A clear indication for propagating modes, and 2) a positive deviation of the collective excitations by about 20 % from the hydrodynamic value. In addition, an indication of a short time (sub-picosecond) retaining of the nearest-neighbour correlation is visualized from the quasielastic line of some non-simple liquid metals [2]. A generalized Langevin formalism with a memory function containing two viscoelastic decay channels [3] is commonly used for analyzing the above IXS data.

In this paper, we review the experimental technique of IXS for liquid metals, and then the common feature of the collective dynamics of liquid metals in detail. Some of them are discussed in connection with results of ab initio molecular dynamic simulations.

[1] Sinn H., et al., *Phys. Rev. Lett.*, 1997, **78**, 1715. [2] Scopigno T., et al., *J. Phys.: Condens. Matter*, 2000, **12**, 8009. [3] Hosokawa S., et al., *J. Phys.: Condens. Matter*, 2003, **15**, L623. [4] Levesque D., et al., *Phys. Rev. A*, 1973, **7**, 1690.

Keywords: x-ray inelastic scattering, phonons, liquid metals