

Effect of Magnetic Force Onnoncontact Laser Modulation Calorimetry of Liquid Cobalt

Hiroyuki Fukuyama^{C, S} and Jun-ichi Takano
IMRAM, Tohoku University, Sendai, Japan
fukuyama@tagen.tohoku.ac.jp

Takao Tsukada
Department of Chemical Engineering, Tohoku University, Sendai, Japan

We have developed a noncontact laser modulation calorimetry to measure heat capacity and thermal conductivity for liquid metals using an electromagnetic levitator under a dc magnetic field [1-4]. A dc magnetic field is applied to suppress surface oscillation, translational motion of the droplet as well as convection in the droplet with the Lorentz force. For measuring heat capacity, convection in the droplet should be remained to promote heat transfer, which provides a quasi-adiabatic condition. In the present study, the heat capacity of liquid cobalt at constant pressure was successfully measured under a lower dc magnetic field of 3 T. On the other hand, convection in the droplet should be minimized to obtain a true thermal conductivity of liquid cobalt. For this purpose, a higher dc magnetic field is required. However, cobalt has a higher magnetic susceptibility even in a liquid state, which generates a magnetic force on liquid cobalt in a magnetic field gradient. This causes unstable levitation, which makes thermal conductivity measurement difficult. In this study, the thermal conductivity of liquid cobalt was measured under dc magnetic fields ranging from 3 to 9 T. The effect of magnetic force on the levitation was quantitatively discussed. Details of experiment, results and discussion will be presented in the symposium.

References

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