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OBSERVATION OF INTERFACIAL PHENOMENA BETWEEN IRON MELT AND MOLTEN OXIDES UNDER MICROGRAVITY

Abstract

Interfacial phenomena between iron melt and molten oxide is very important for process control of steel productions, such as smelting, continuous casting and welding. Therefore, we are planning to measure interfacial tension between iron melt and molten oxide precisely including its temperature dependence and oxygen effects by international research group. Our measurements of interfacial tension would be performed in International Space Station (ISS) using electrostatic levitation furnace (ELF) with non-contact surface oscillating and temperature detection devices. We have already confirmed from the analytical studies and the numerical simulations that the surface oscillation of the core-shell droplet has two independent frequencies and, also that they depend on the radius ratio of core and shell drop and on the viscosity ratio of them[1)]. From these two surface frequencies we can obtain interfacial tension from the analytical equation of core-shell drop surface oscillation. To perform ISS experiments, we should clarify to make core-shell droplet conditions because two immiscible liquids drop can form core-shell drop or partially engulfing shape, which are called Janus drop. For the requirement, we performed parabolic flight experiment[2)] to observe droplet formations of immiscible two liquids by iron melt and molten oxide under microgravity. From the experiments, we clarified the conditions of equilibrium shape forming of the immiscible liquids droplet, in which present case is molten oxide and iron melt. Also, from the experiment, we found that the equilibrium shape of immiscible liquids drops is decided by the balance of total surface free energies including the interface. Using these results, we designed the experimental conditions for measurements of interfacial tension between iron melt and molten oxide. In the presentations, we review our preparative experimental results for ISS experiments and introduce the ground experiments of observations of surface oscillation of immiscible liquids droplet using aerodynamic levitation (ADL) technique[3)].

1) M. Watanabe *et al.*, Int. J. Microgravity Sci. Appl., 33 (2016) 330212.
2) K. Onodera *et al.*, Int. J. Microgravity Sci. Appl., 33 (2016) 330218.
3) S. Hakamada *et al.*, Int. J. Microgravity Sci. Appl., 34 (2017) 340403.