Measurement of Interfacial Tension and Thermophysical Properties of Molten Steel and Oxides

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We have been planning measurements of the interfacial tension between molten oxides and steel melts using a core-shell droplet with oscillating drop technique under microgravity conditions in the International Space Station (ISS) [1]. Interfacial tension values are needed for industrial application in steel making processing; therefore the measurement is very important to make next generation steel products. Steel melts and molten oxides are immiscible with each other, therefore these two liquids form a core-shell droplet under microgravity. The basis of our measurement technique of the interfacial tension is analytical solutions of the core-shell drop surface oscillation without viscous effects. We have already confirmed from the numerical simulations that the surface oscillation of the core-shell droplet agrees with the analytical solutions of the surface oscillation of core-shell droplets. In numerical simulations, we include the viscous effect on the surface oscillations. In order to confirm experimentally the viscous effect on the surface oscillation of core shell droplet, we performed the parabolic flight (PF) experiment to perform the observation of the surface oscillation of core-shell droplets by iron melt and molten oxides under short duration microgravity conditions [2]. From PF experiments and numerical simulations, we found that the viscous effect on the surface oscillations of the core-shell droplets. From these situations, for ISS experiments oxide samples we obtained the viscosity values using ISS experiments using aerodynamic levitation techniques. In the presentations, we discuss the viscous effects of molten oxides on the surface oscillations of core-shell droplets by iron melt on molten oxides.

References:

[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.