Measurements of Thermophysical Properties of Molten $Zr_{76}Ni_{24}$ Alloy Using the High Temperature Electrostatic Levitator

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Thermophysical properties of a molten $Zr_{76}Ni_{24}$ alloy have been measured using the High Temperature Electrostatic Levitator (HTESL). In the HTESL the melt was well isolated in a high vacuum condition and it extended the liquid state more than 200 K below the melting temperature as it undercooled. The measured properties include the density, the thermal expansion coefficient, the surface tension, the viscosity, and the ratio between the specific heat and the hemispherical total emissivity. All of these properties were measured as a function of temperature over a 300 K span which included the melting point. A sample material, ~3 mm in size was levitated and thermophysical properties were measured using various non-contact diagnostic methods. The density and the thermal expansion coefficient were determined through the sample volume measurements at different temperatures [1]. The surface tension and the viscosity of the sample were obtained by observing the resonant oscillation of the drop. The freely decaying oscillation immediately following an excitation pulse was observed, and the frequency and the damping constant of this oscillation could be related to the surface tension and the viscosity of the sample material [2]. After a brief introduction of these relatively new non-contact diagnostic techniques, which have been developed for the HTESL, the data on a molten $Zr_{76}Ni_{24}$ alloy will be presented and discussed on the basis of the data available in literature. The presentation will conclude with a summary on current capabilities of HTESL for studies of materials science.

[1] S.K. Chung, D.B. Thiessen, and W.K. Rhim, "A Noncontact Measurement Technique for the Density and Thermal Expansion Coefficient of Solid and Liquid Materials," *Rev. Sci. Instrum.* **67**, 3179 (1996).

[2] W.K. Rhim. K. Ohsaka, and R.E. Spjut, "Surface Tension and Viscosity Measurements by Electrostatic Levitation (in preparation).