

Precision Containerless Density Measurements of $\text{Zr}_{62}\text{Ni}_8\text{Cu}_{20}\text{Al}_{10}$

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Accurate thermophysical property measurements performed at high temperatures of very reactive alloys can be difficult as a result of contamination from processing containers and measuring apparatus. Properties such as surface tension can be altered drastically by the presence of contaminants. This problem may be solved by using containerless processing techniques in which contact from containers and measuring devices is eliminated. One of the most common forms of containerless processing is levitation, where a variety of techniques such as electromagnetic, acoustic, aerodynamic or electrostatic levitation may be used. Unique benefits from containerless processing include reduction of available heterogeneous nucleation sites providing access to deeply undercooled regimes. This in turn provides the capability to study metastable phases. However, given the non-contact nature of containerless processing, properties must also be measured using non-contact methods. Modern machine vision techniques can provide this, and many properties such as surface tension, viscosity and density can be measured. Density in particular is especially important as it is used to measure other properties such as surface tension and is commercially desirable for manufacturing purposes. A new method capable of measuring density with a precision of approximately 300-500 parts per million (ppm) has been applied to determine the density of the glass-forming alloy $\text{Zr}_{62}\text{Ni}_8\text{Cu}_{20}\text{Al}_{10}$ in the stable and undercooled liquid state.