

Viscosity of liquid gallium

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Abstract

The low melting point of gallium makes it possible to widely use it as a coolant in cooling systems of nuclear reactors and high-power electronic components, as well as in metallic composite products. Information about the viscosity is very important for the optimal design and operation of devices used for the transport and pumping of liquid metals. However, the discrepancies in the results presented in the literature and the very limited temperature range of the studies require new precise measurements to obtain reliable data on the viscosity of liquid gallium over a wide temperature range. In the present paper, the viscosity of liquid gallium was determined by an oscillating cup from the room temperature to 1200 K. The error of the viscosity measurements did not exceed 2.5%. This method is the most reliable and widely used for measuring the viscosity of metallic melts at high temperatures. To obtain reliable experimental data on the viscosity of gallium, we studied the effect of the meniscus and the possibility of forming an oxide film on the surface of liquid gallium. It is established that the viscosity of liquid gallium over the entire temperature range is well described by the Arrhenius equation. The activation energy of the viscous flow of liquid gallium, determined from this equation, is 3813.2 ± 28.7 J/mol. The obtained experimental results on the viscosity of liquid gallium are compared with the data available in the literature. The results of the comparison show that the results of our measurements are in good agreement with the most reliable literature data.

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