Thermophysical Properties of New Ga-Sn-Zn Liquid Alloys

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Liquid metals are defined as elements or alloys with a melting point near room temperature. Those new functional materials are studied for a number of applications, including for soft and stretchable electronics [1], medicine [2], in scientific equipment, thermal management of various systems [3], as well as to obtain nanomaterials [4]. In the case of any of those applications the thermophysical properties are crucial to use liquid alloys in an effective way.

In this work, we propose the use of non-toxic, gallium-based alloys as an alternative to toxic mercury or to more expensive Ga-In-Sn alloys. The Ga-Sn-Zn has been explored in terms of thermodynamics in [5]. Based on those assessment the density, viscosity and surface tension in the system has been calculated via different models, such as including the Egry model for density, Sato, Kucharski, Moelywen-Hughes, Kozlov, Romanov and Petrov, Schick and Gasior models in the case of viscosity and Kohler, Toop, Muggiano and Butler models for the surface tension. In order to further understand the studied system, the thermophysical properties have been analysed using the discharge crucible method [6], that allows to simultaneously measure all three mentioned properties in a large temperature range (in the case of the presented study 323-823 K). The obtained results are of great importance in order to develop future models more adapted for low melting point materials, as well as for the mentioned potential applications.

References

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