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Surface tension and viscosity measurements on laser heated liquid gallium droplets using acoustic levitation and oscillations methods

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Advanced techniques for liquid metal processing and casting, such as monocrystalline casting, atomization for powder metallurgy, metallic additive manufacturing, welding or ingots refining processes, are complex to master. Developing and controlling industrial equipment is costly and so manufacturers are promoting digital design methods. But numerical models rely on accurate knowledge of thermophysical properties, such as surface tension and viscosity, to be effectively representative of real processes. Due to the strong chemical reactivity of liquid alloys at high temperatures (> 1000℃), measurements with contact are easily biased. We have developed a non-contact laser-powered melting furnace, based on the acoustic levitation phenomenon, to perform these measurements on samples in liquid form. Current stable levitation conditions allowed us to carry measurements on molten gallium up to 500℃. Influence of samples temperature and shape, as well as oxygen content of the surrounding atmosphere, on the properties magnitude is emphasized. Perspectives for measurements on high melting point reactive alloys are discussed.

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