

PRODUCT DATA SHEET

Liquid Metal

Gallium and Gallium Alloys

Introduction

Indium Corporation provides several low-melting point Indalloy® alloys that are liquid at room temperature. These low-melting point Indalloys are gallium-based and can be used as non-toxic replacements for mercury due to their lower vapor pressure, which reduces both the amount and the toxicity of metal vapor exposure when used.

Thermal and Electrical Conductivity

Due to natural properties of metals, their valence electrons are able to conduct heat and electricity. Because of this, liquid metals have thermal conductivity far superior to non-metallic liquids. In applications, liquid metals are used for dissipating concentrated heat loads such as thermal interfaces for microprocessors, reactors, and heat exchangers. Liquid gallium alloys are inherently high-density and low-viscosity (similar to that of water, <8 cP at room temperature¹). Since they are based with electrically conductive metals, gallium alloys are used for mercury replacements in switches and contacts.

Wetting to Metallic and Non-Metallic Surfaces

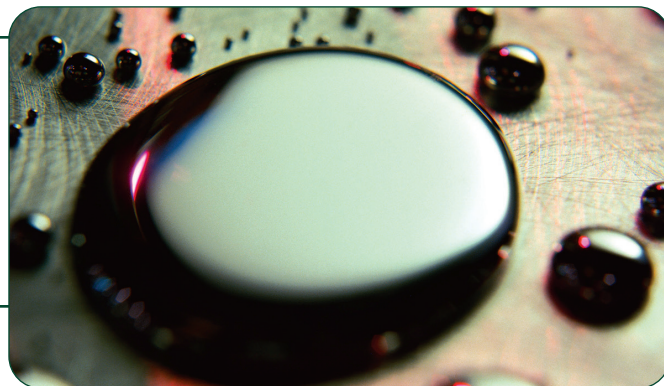
Gallium-based liquid metal alloys will wet to most metallic and non-metallic surfaces. Through this, gallium alloys are able to serve as high-temperature lubricants in journal bearings. Gallium's corrosive nature dissolves most metals at higher temperatures, but there are solutions. Refractory metals are resistant to this dissolution: tungsten and tantalum are the most resistant, followed by columbium, titanium, and molybdenum^{2,3}.

Structural materials such as steel, stainless steel, and nickel alloys can generally tolerate exposure to gallium up to the 300–500°C range. However, even at ambient temperatures, gallium is particularly corrosive toward aluminum; care should be taken to avoid contact with aluminum components.

Like indium, gallium and gallium alloys have the ability to wet to many non-metallic surfaces such as glass and quartz. Gently rubbing the gallium alloy onto the surface in question may help induce wetting.

Note: These alloys form a thin, dull-looking oxide skin that is easily dispersed with mild agitation. The oxide-free surfaces are bright and lustrous.

1. Smithells, Colin J, ed. *Metals Reference Book*, 5th edition, London, UK 1976.
2. *Pergamon Texts in Inorganic Chemistry Volume 12, The Chemistry of Aluminum, Gallium, Indium and Thallium* by K. Wade & A.J. Banister, University of Durham, Pergamon Press, 1975.
3. Lyon, Richard N, ed. *Liquid Metals Handbook*, 2nd edition, Washington DC, 1952.



Applications

Typical applications for these materials include thermostats, switches, barometers, heat transfer systems, thermal cooling and heating designs, and TIM2 interfaces.

Packaging

Alloys are packaged in polyethylene bottles and 3cc, 5cc, and 6 oz. syringes, and are shipped in accordance with applicable federal regulations.

Note: Gallium alloys expand when they solidify. Accordingly, these alloys should not be stored in glassware below the melting temperature.

Storage and Shelf Life

Unopened bottles and syringes have a guaranteed shelf life of one year. Syringes should be stored in an upright position with the tips down. If stored in polyethylene bottles, it is recommended that as the material is removed from the bottle, the volume should be replaced with dry argon. This minimizes the possibility of oxidation on the surface of the alloy. If the alloy has been stored below its melting point and has solidified, it should be remelted and thoroughly shaken or mixed before use. When reheating the alloy in its original packaging, do not exceed 65°C.

Technical Support

Indium Corporation sets the industry standard in providing rapid response, onsite technical support for our customers worldwide. Indium Corporation's team of Technical Support Engineers can provide expertise in all aspects of Materials Science.

Safety Data Sheets

Please refer to the SDS document within the product shipment, or contact our local team to receive a copy.



From One Engineer To Another®

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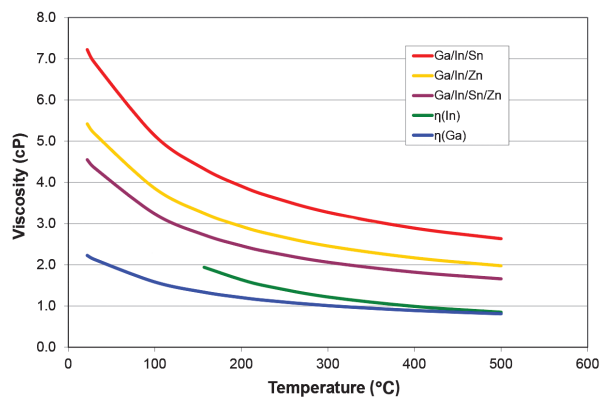
Liquid Metal Gallium and Gallium Alloys

Available Alloys

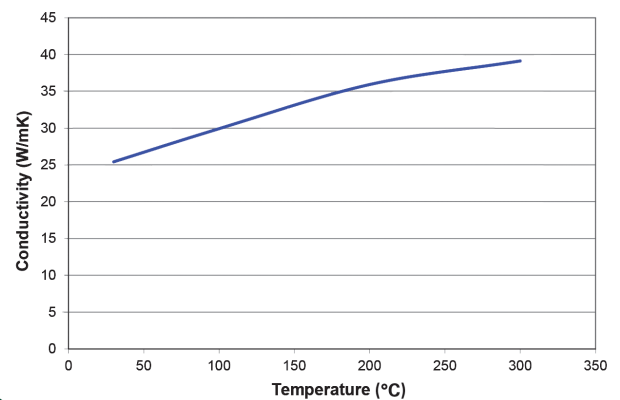
Indalloy® Number	Composition	When to Choose	Liquidus (°C)	Solidus (°C)	Thermal Conductivity (@85°C W/mK)	Electrical Resistivity (10 ⁸ Ω-m)	Density (g/cc)	RoHS Compliant
51E	66.5Ga/20.5In/13.0Sn	Lower melting point eutectic alloy best used in dispensing and printing applications	11	11	37	28.9	6.32	Yes
300E	78.6Ga/21.4In	Highest thermal conductivity and best for jetting applications	15.7	15.7	44	27	6.16	
306	68.5Ga/21.5In/10Sn	Widely used in high-end gaming platforms	19	10	37	28.9	6.44	

Other Liquid Metal Alloys available upon request. Please contact Indium Corporation to discuss your specific needs.

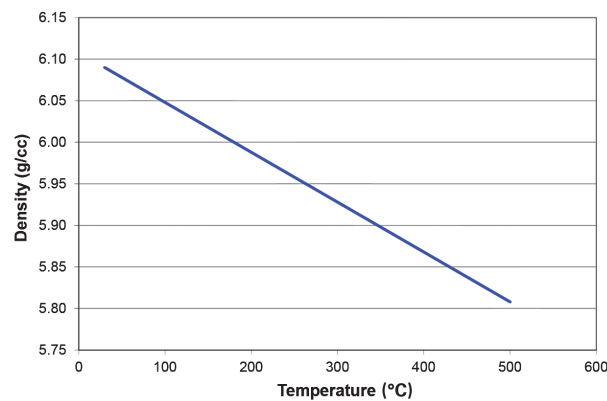
Estimated Viscosity of Gallium Alloys



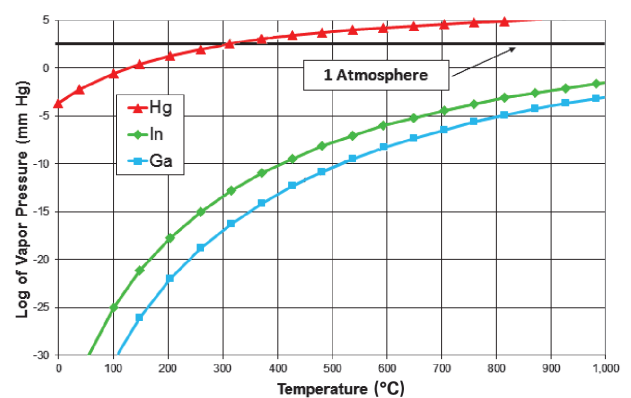
Thermal Conductivity of Gallium



Density of Gallium



Vapor Pressure versus Temperature



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All of Indium Corporation's solder paste and preform manufacturing facilities are IATF 16949:2016 certified.
Indium Corporation is an ISO 9001:2015 registered company.

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