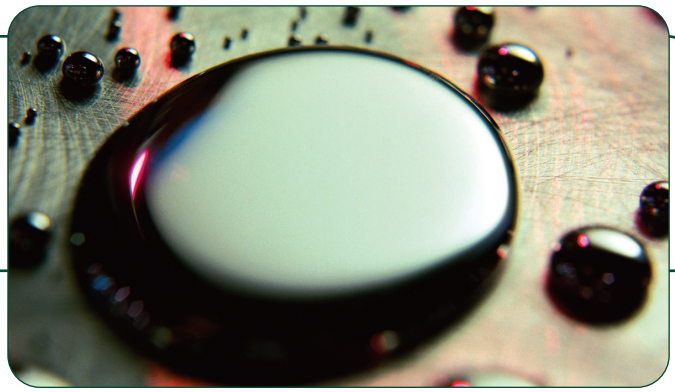
PRODUCT DATA SHEET

Liquid Metal

Gallium and Gallium Alloys

Introduction

Several low-melting point **Indalloy®** alloys are liquid at room temperature. These gallium-based alloys are non-toxic replacements for mercury. The gallium-based alloys have far lower vapor pressure than mercury, reducing both the amount and toxicity of metal vapor exposure.



Excellent Thermal and Electrical Conductivity

Metals conduct heat and electricity with their valence electrons. This very effective conduction mechanism is a property of liquid as well as solid metals and alloys. Accordingly, liquid metals have thermal conductivity far superior to non-metallic liquids. Liquid metals are used in applications 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 temperature[1]). As an electrically conductive metal, gallium alloys are used for mercury replacements in switches and contacts.

Wetting to Metallic and Non-Metallic Surfaces

These alloys will wet to most metallic and non-metallic surfaces. This wetting behavior and lubricity enable gallium alloys to serve as high-temperature lubricants in journal bearings. However, gallium will attack (it alloys with) some metals, even at room temperature. At higher temperatures, gallium dissolves most metals although the refractory metals, particularly tungsten and tantalum, are resistant to this dissolution. Columbium, titanium, and molybdenum also have this resistance, but less than tungsten and tantalum[2,3].

Structural materials such as steel, stainless steel, and nickel alloys can generally tolerate gallium service up to the 300–500°C range. However, even at ambient temperatures, gallium is particularly aggressive in dissolving 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 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.

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.

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.

From One Engineer To Another®

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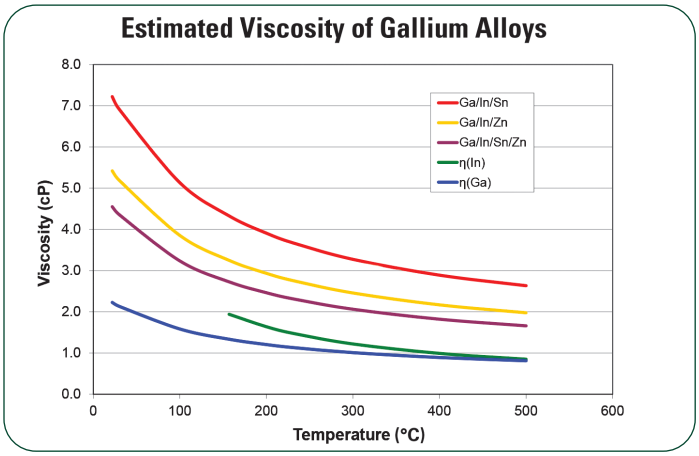
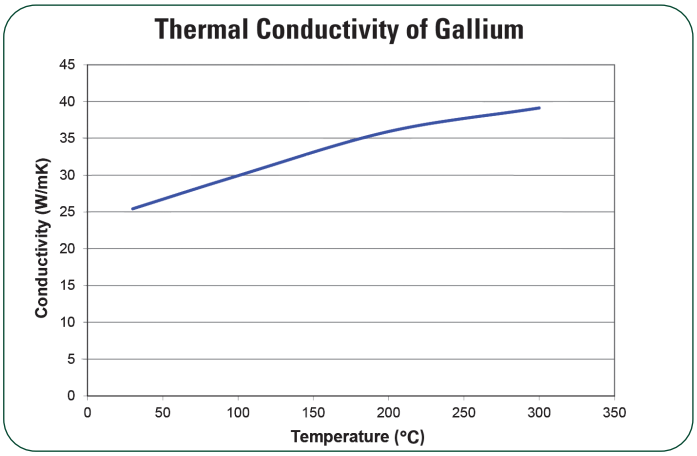
Liquid Metal Gallium and Gallium Alloys

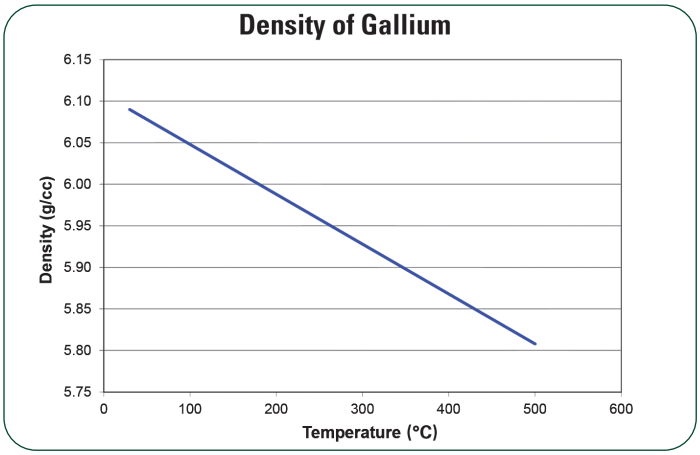
Available Alloys

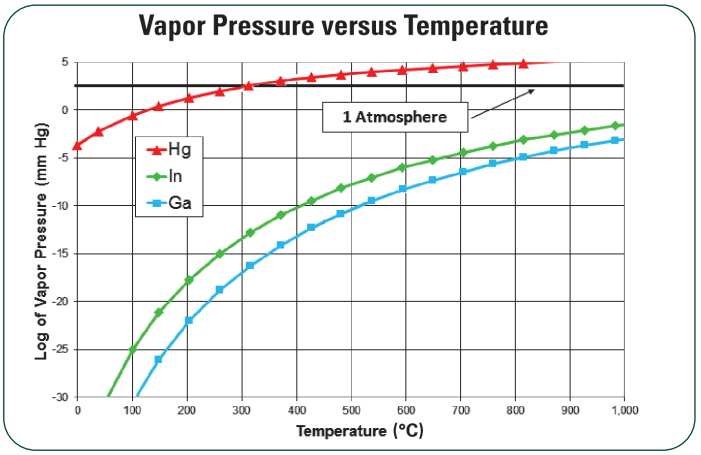
Indalloy® Number	Composition	When to Choose	Liquidus (°C)	Solidus (°C)	Thermal Conductivity (@85°C W/mK)	Electrical Resistivity (10^8 Ω-m)	Density (g/cc)	RoHS Compliant
51E	66.5Ga/20.5In/13.0Sn	Lower melting point eutectic alloy best used in dispensing and printing applications	11	11	47	28.9	6.32	Yes
300E	78.6Ga/21.4In	Highest thermal conductivity and best for jetting applications	15.7	15.7	44	27	6.16	
306 (AKA)	68.5Ga/21.5In/10Sn	Widely used in high-end gaming platforms	19	10	35	29	6.44	

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









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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