

# PRODUCT DATA SHEET

# Bismuth Solder

## Introduction

**Bismuth** (Bi) is being used more and more as a replacement for lead in solder alloys because it is non-toxic. Although the melting temperature of pure bismuth is 271°C, the addition of bismuth will lower the melting temperature of most metals it is alloyed with. **Bismuth** compounds are also widely used in medical and cosmetic applications.



## Features

- The most popular lead-free **bismuth** solder alloys are Indalloy®281 (58Bi/42Sn) which melts at 138°C and Indalloy®282 (57Bi/42Sn/1Ag) which melts at 140°C. The addition of the 1% Ag makes the alloy more malleable. Both alloys can be used for step soldering applications. After the initial joints are made with a standard SAC alloy (220°C), subsequent soldering operations can be done using the **bismuth** alloys. See the table on the back of this sheet for additional alloys.
- Indalloy®281 and Indalloy®282 have joint properties similar to those of tin-lead solders, with superior fatigue and copper dissolution characteristics.
- **Bismuth** is the most diamagnetic and the least thermally conductive of all metals.
- In addition to being non-toxic, it does not oxidize as readily as lead does.

## Applications

The high density of **bismuth** (9.80g/cm<sup>3</sup>) makes it a good choice as a replacement for lead (11.35g/cm<sup>3</sup>) in applications where density is important.

Some **bismuth**-based alloys will also expand on cooling, making them ideal for applications where filling a cavity is required.

The low melting temperatures of these alloys make them widely used for fire suppression or fuse applications. A cylinder or other shape of a **bismuth** alloy is placed in a device and when the melting temperature of the alloy is reached and the part melts, it either allows a change in the device (allowing water to release in a fire suppression device) or interrupt a circuit to reduce the risk of a fire.

## Forms of Bismuth

**Bismuth** as a pure element is very brittle. When **bismuth** is added to tin or lead, the **bismuth** works to reduce the melting temperature of the resulting alloy and the tin or lead works to reduce the brittleness of the alloyed material. Generally, alloys of up to 58% **bismuth** produce the most workable product.

In solid wire form, diameters start at .010" and can go up to .250" or larger. Preforms can be produced in thicknesses starting at .001".

The minimum temperature for a solder paste is 96°C, the general lower limit for flux activation. The **bismuth**-containing alloys that melt below 96°C are generally used in fuse applications where a flux is not required.

## Technical Support

Indium Corporation's internationally experienced engineers provide in-depth technical assistance to our customers. Thoroughly knowledgeable in all facets of Material Science as it applies to the electronics and semiconductor sectors, Technical Support Engineers provide expert advice in solder properties, alloy compatibility and selection of solder preforms, wire, ribbon, and paste. Indium Corporation's Technical Support engineers provide rapid response to all technical inquiries.

## Safety Data Sheets

The SDS for this product can be found online at <http://www.indium.com/sds>

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Below is a list of the most common **bismuth** alloys.

A listing of many others is available by requesting our Solder Alloy Directory.

Indalloy® #	Composition	Liquidus (°C)	Solidus (°C)	Comments
42	46Bi/34Sn/20Pb	96	96	Low-temperature eutectic solder. Can be used on the same metallizations as SnPb solders. Lowest temperature alloy available as a solder paste.
281	58Bi/42Sn	138	138	Eutectic Pb-free version. Low melting temperature that is good for step soldering applications.
282	57Bi/42Sn/1Ag	140	139	More malleable and ductile than Indalloy®281.
97	43Sn/43Pb/14Bi	163	144	Good general purpose step soldering alloy.
281-338	60Sn/40Bi	170	138	General purpose Pb-free alloy with good physical properties.

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