

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 (57Bi42Sn1Ag) 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 chart for additional alloys.
- Indalloy #281 and #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 (9.80 g/cm³) makes it a good choice as a replacement for lead (11.35 g/cm³) 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.

Material Safety Data Sheet

The MSDS for this product can be found online at <http://www.indium.com/techlibrary/msds.php>

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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	Solidus	Comments
42	46Bi 34Sn 20Pb	96°C	96°C	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°C	138°C	Eutectic Pb-Free version. Low melting temperature that is good for step soldering applications.
282	57Bi 42Sn 1Ag	140°C	139°C	More malleable and ductile than #281.
97	43Sn 43Pb 14Bi	163°C	144°C	Good general purpose step soldering alloy.
281-338	60Sn 40Bi	170°C	138°C	General purpose Pb-Free alloy with good physical properties.

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