Metal Thermal Interface Materials

Compressible Metal SMA-TIM Heat-Spring®

Introduction

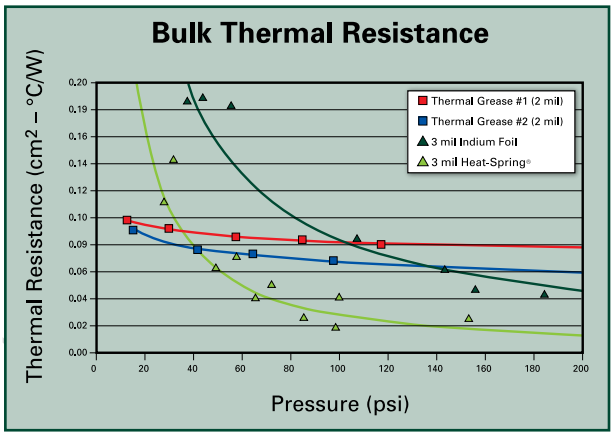
Indium Corporation's **Soft Metal Alloy Thermal Interface Materials (SMA-TIM)** exhibit superior thermal conductivity, compressibility, and ease of application. **SMA-TIM Heat-Springs®** made from indium metal are a highly effective choice for high-end cooling devices.

Specifications

Typical Dimensions	**25.4mm x 25.4mm x 0.05-0.3mm (1" x 1" x .003"-.012") up to 4" x 6"**
Application Pressure	**>30psi**
Alloy Purity Level	**99.99% In, 52In/48Sn**
Max. Operational Temp.	**140°C**
Thermal Conductivity	**86W/mK**

Compressed Interface Application

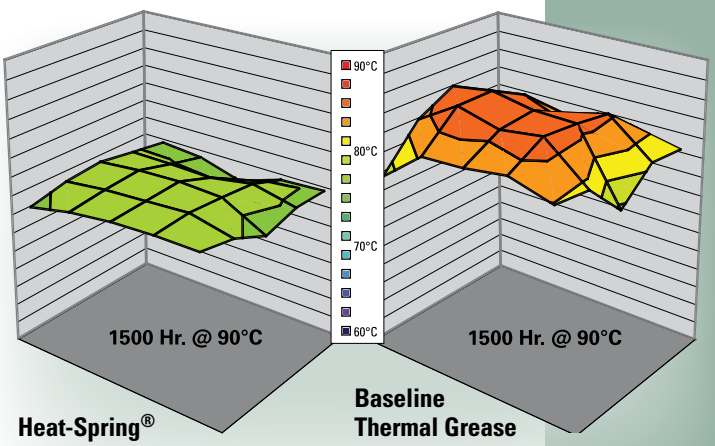
Heat-Springs offer uniform thermal resistance at lower applied stresses in compressed interfaces. The malleability of indium minimizes surface resistance and increases heat flow. Our patented Heat-Spring technology further reduces the thermal resistance.



Reliability

Indium Corporation's high-end thermal interface materials deliver superior performance. As Heat-Springs are made of metal, they do not experience pump-out, even under power cycling. Heat-Springs, which do not contain silicone, will conform to surface irregularities, thereby reducing thermal resistance through the life of the TIM. Due to its solid state, Heat-Springs also resist bake-out as shown in the bulk thermal resistance diagram.

Indium Corporation's SMA-TIM vs. Thermal Grease



Lower temperatures confirm the superiority of Indium Corporation's SMA-TIM Heat-Spring® vs. Thermal Grease.

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From One Engineer To Another®

http://indium.us/F025

http://indium.us/F028

Solder Preforms

Introduction

Solder preforms are used in a variety of applications that require precise amounts of solder.

Preforms come in standard shapes such as squares, rectangles, washers, and discs. Typical sizes range from 0.254mm (0.010") up to 50.8mm (2.00"). Smaller and larger sizes, as well as custom shapes, are also available. Dimensions can be held to tight tolerances to ensure volume accuracy.

Selecting Alloys

A wide assortment of alloys is available in liquidus temperatures that range from 47°C to 1063°C. Alloys can be indium-contained, gold-contained, lead-free, fusible, and tin-lead, as well as many others.

1. Alloy selection should be based on strength and other required physical properties, as well as the preferred soldering temperature and the operating temperature of the device being soldered. A general rule is to select an alloy that melts at least 50°C higher than the operational temperature of the part being soldered.
2. Next, consider the materials being soldered and which solder is most compatible with them. For example, tin-based solders will scavenge the gold from gold-plated parts, forming brittle intermetallics. Therefore, indium-based solders are generally recommended in these cases.
3. Metals and alloys have different characteristics that can affect the ease in which they can be made into different shapes and thicknesses. It is important to consider the shape of the final preform in the alloy selection process.
4. The operating environment of the completed assembly is also an important consideration for alloy selection. Will it operate in very high or very low temperatures, or be subjected to vibration? If so, you need to select an alloy that will stand up to these conditions.

Our Application Engineers will work with you to determine the best alloy for your application.

Selecting Dimensions

The location of the solder joint and the volume of solder needed will determine the size and shape of the preform. Once the flat dimensions (diameter, length, width) have been determined, the thickness can be adjusted to achieve the desired volume of solder. Generally, for through-hole connections, add 10–20% to the calculated volume for a good fillet. For pad-to-pad joints, figure about 5% less surface area than the pad.

Each **solder preform** should have a burr tolerance specified. You should stay as close to standard tolerances as possible to avoid adding cost and lead time to your preforms.

Indium Corporation has an extensive library of sizes and shapes from which to choose. We can also create a set-up specifically for your application. Using an existing preform size can eliminate the additional time associated with creating a new set-up.

Dimensional Specification Recommendations

Width/Length or Diameter:	Typical Tolerances
Up to 2.54mm (0.100")	± 0.051mm (± 0.002")
Over 2.54mm (0.100")	± 0.127mm (± 0.005")
Thickness:	
Up to 0.025mm (0.001")	± 0.005mm (0.0002")
0.025mm (0.001") to 0.050mm (0.002")	± 0.0076mm (0.0003")
> 0.050mm (0.002") to 0.254mm (0.010")	± 0.0127mm (0.0005")
> 0.254mm (0.010") to 0.508mm (0.020")	± 0.0254mm (0.0010")
> 0.508mm (0.020") to 1.27mm (0.050")	± 0.0635mm (0.0025")
> 1.27mm (0.050")	± 5%
Burr Tolerances (Discs, Squares & Rectangles):	
≤ 1.27mm (0.050")	0.050mm (0.002")
> 1.27mm (0.050") to 12.7mm (0.500")	0.076mm (0.003")
> 12.7mm (0.500")	0.127mm (0.005")
Burr Tolerances (Washers & Frames):	
≤ 2.54mm (0.100")	0.076mm (0.003")
When thickness ≥ 2/3 of I.D.	0.127mm (0.005")

Solder Metal TIMs

http://indium.us/F027

Introduction

Thermal interface materials are useful for a variety of applications, but **solder thermal interface materials (sTIM)** are especially suited to high-end device cooling. To improve package reliability, it is especially important to choose the right alloy. Indium, in particular, should be considered a sTIM because of its high thermal conductivity, compressibility (SMA-TIM), and ease of application.

Specifications

Max. Operational Temp.	125°C
Standard Purity Level	99.99%
Typical Size	25.4mm x 25.4mm x 0.05-0.3mm (1.00" x 1.00" x 0.002"-0.012")

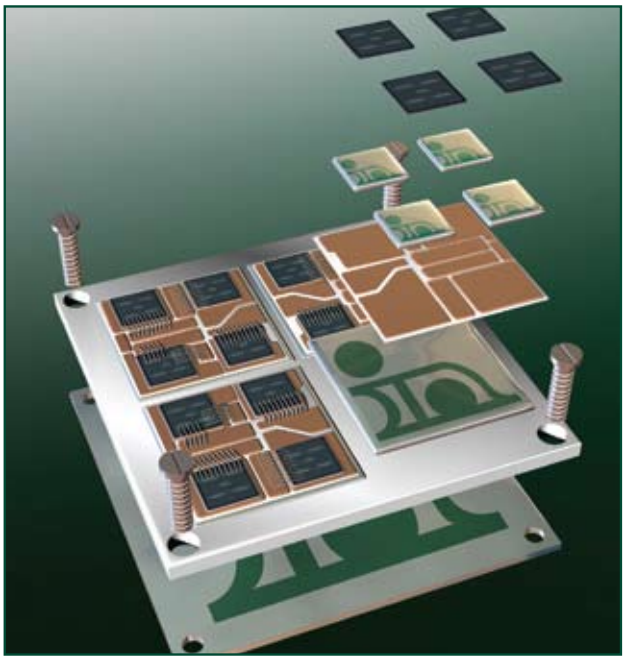
Applications

Indium preforms may be used in a variety of processes.

- **Compressed Between Two Surfaces Without Reflow**
  Heat-Spring®
  The extreme malleability of indium allows it to minimize surface resistance, thereby increasing heat flow.
- **Soldered Between Two Surfaces**
  Solder-TIM (sTIM)
  Used to further improve thermal resistance, this application may require the use of a flux to reduce oxides on soldering surfaces.
- **Cold-Welding**
  Another process that is used to create a thermal interface involves reflowing indium preforms onto each solderable surface. The indium-coated surfaces can be pressed together to form a fluxless cold-weld solder joint. (See the Application Note: *Etching Indium to Remove Oxides* for more information about this process.)

Storage and Packaging

Metal TIM preforms come in a variety of packaging, including tape & reel and custom adhesive carriers for direct-attach to heat-sinks. To minimize excessive handling and oxidation due to air exposure, keep TIM preforms in their original container in a cool, dry place. Indium **metal TIMs**, when exposed to air, will self-passivate to approximately 10 nanometers and will have a useful life of at least six months. **Metal TIMs** can also be stored in an inert atmosphere, such as nitrogen.



Properties

Indalloy®	#4
Electrical Conductivity (% of IACS) (1.72microhms-cm)	24
Thermal Conductivity (W/mK) (@ 85°C)	86
Coefficient of Thermal Expansion (µin/µin per °C) (@20°C)	29
Density (lb/cu. in.)	0.2641
Mass Density (gm/cm^3)	7.31
Tensile Strength (PSI)	273
Shear Strength (PSI)	890
Young's Modulus (PSI X 10x6)	1.57
% Elongation	22 to 41
Brinell Hardness (2mm ball, 4kg load)	0.9
Latent Heat of Fusion (J/g)	28.47
Melting Point (°C)	156.7

Material Safety Data Sheet

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

Locations Worldwide

- Electronics Assembly Materials
- Engineered Solders & Alloys
- Metals & Compounds
- Metal Thermal Interface Materials
- Nanotechnology
- Semiconductor Assembly Materials
- Solar Energy Materials

Our Goal

Increase our customers' productivity and profitability through premium design, application, and service using advanced materials.

Our basis for success:

- *Excellent product quality and performance*
- *Technical and customer service*
- *Cutting-edge material research and development*
- *Extensive product range*
- *Lowest cost of ownership*

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