

Indium/Lead Soldering to Gold

APPLICATION NOTE

Many components and printed circuit boards are plated with varying thicknesses of gold ranging from a flash, (10-15 microinches,) to several hundred microinches. To produce an acceptable joint when soldering to gold-plated components and boards, the wetting capability of the solder in the presence of a suitable flux, as well as the scavenging rate of the solder, must be considered. For long-term reliability of a soldered assembly, a thermally aged solder joint must not be brittle or susceptible to fatigue cracking.

The usefulness of tin/lead eutectic and off-eutectic solders is limited by their tendency to rapidly dissolve large quantities of gold. This dissolution is commonly called scavenging and can lead to complete and irreparable destruction of gold conduction patterns. A tin-bearing alloy requires less than 30 seconds to completely scavenge and destroy a thick film gold layer.

Lead/indium solders are known to cause appreciably less scavenging damage than tin/lead, and are satisfactory for use on gold films thicker than 1 micron. In addition, provided the thickness of the gold and the lead/indium solder layers are in the correct proportion and the gold layer does not exceed 10 microns, the formation of brittle intermetallic layers can be avoided and satisfactory joints produced.

In fact, tests have shown the solubility ratio of eutectic tin/lead solder compared to 50In, 50Pb solder is 13-to-1 at 250°C.¹ This factor alone makes the consideration of an indium-bearing alloy for gold surfaces soldering a very logical choice, since wettability is entirely adequate.

In general, soldering with indium-based solders is almost identical to soldering with tin/lead. Similar fluxes, hot plates, and soldering irons can be used. Mildly-activated rosin fluxes are generally suitable for most applications.

All alloys in the indium/lead system are relatively ductile and can be cast and cold-rolled without intermediate anneals. Discrete components can easily be soldered to plated, vapor deposited and

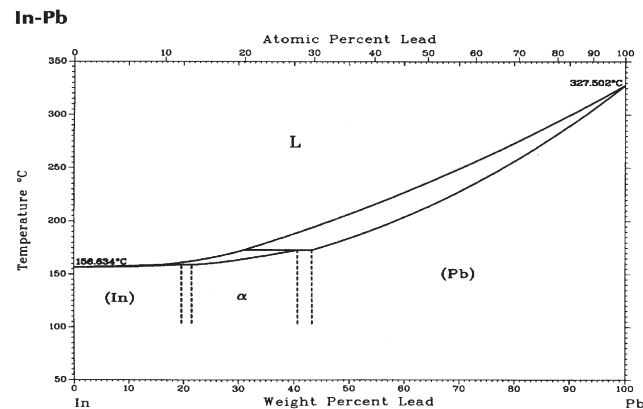
thick film gold as well as bulk gold using a variety of techniques.

The indium/lead system (see phase diagram below) contains a wealth of useful solder alloys having solidus temperatures which range from 156.6°C (pure indium) to 327.5°C (pure lead). However, since the wettability for solder alloys containing in excess of 80% lead is poor, solders should be selected that contain less than 80% lead. The melting range (liquidus temperature minus solidus temperature) is largest for those alloys lying between 10 and 50 weight percent indium. There are two peritectic reactions, one at 171.6°C and another at 158.9°C, and an intermediate phase which has variable composition and a body-centered tetragonal crystal structure.

The most commonly used alloy is the 50 weight percent indium composition which has a liquidus temperature of approximately 210°C and a solidus temperature of approximately 185°C. Alloys in the lead-rich phase field freeze dendritically by forming lead-rich stalks. The formation of these dendrites causes a surface dimpling which gives the solder surface a somewhat frosty rather than a shiny appearance.

If the device operating temperature exceeds 125°C, indium-based solders are not recommended for use against gold metallizations, as solid state diffusion of gold may occur. In such cases you must rely on the gold-tin eutectic solder.

Indium/Lead Phase Diagram



¹ "Aspects of Lead-Indium Solder Technology", Fredrick G. Yost, Sandia National Laboratories, reprints available from Indium Corporation of America.

This product data sheet is provided for general information only. It is not intended, and shall not be construed, to warrant or guarantee the performance of the products described which are sold subject exclusively to written warranties and limitations thereon included in product packaging and invoices.

Form No. 97746 R1

S O L D E R

INDIUM CORPORATION OF AMERICA®

www.indium.com
 askus@indium.com
 PRC +86 (0)512 628 34900
 SINGAPORE +65 6 268 8678
 UK +44 (0) 1908 580400
 USA +1 315 853 4900

