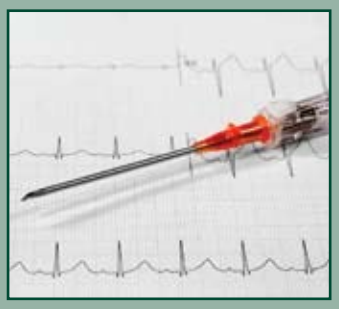
Gold Solder Alloys

Gold-based solders have unique traits:

- Reliability
- Strength
- Corrosion-resistant
- Inert

Making them ideal for a variety of applications:

- Ultra high reliability joining and sealing
- Fluxless soldering processes
- Hermetic sealing
- Joining gold plated surfaces



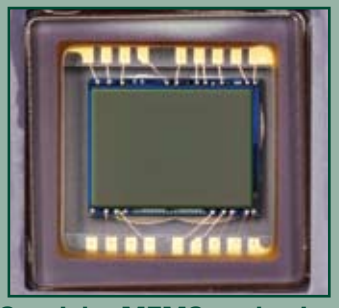
Medical

Aerospace

Defense

Package sealing

Optics



Specialty MEMS packaging

INDIUM® CORPORATION®

From One Engineer To Another®

Gold Solder Alloys

Additional advantages of gold-based solder:

- Highest tensile strength of any solder
- High melting point is compatible with subsequent reflow processes
- Pb-free
- Superior thermal conductivity
- Resistance to corrosion
- Superior thermal fatigue resistance
- Good joint strength
- Excellent wetting properties
- Resistance to oxidation

AuSn Compared to Standard Solders

Indalloy® Properties	80 Au/20Sn	96.5Sn/3.5Ag	63Sn/37Pb	58Bi/42Sn
Solidus Temperature (°C)	280	221	183	138
Liquidus Temperature (°C)	280	221	183	138
Thermal Conductivity (W/mK)	57	33	50	19
Tensile Strength (PSI)	40,000	5,800	7,500	8,000
Shear Strength (PSI)	40,000	2,700	6,200	500
Thermal Expansion Coefficient @20°C (PPM/°C)	16	30	25	15

Gold Eutectic Alloys

Indalloy® Properties	Au20Sn	Au12Ge	Au3.2Si
Solidus Temperature (°C)	280	356	363
Liquidus Temperature (°C)	280	356	363
Thermal Conductivity (W/mK)	57	44	27
Tensile Strength (PSI)	40,000	26,835	36,975
Shear Strength (PSI)	40,000	26,825	31,900
Thermal Expansion Coefficient @20°C (PPM/°C)	16	13	12

Material Specs

- Casting process designed to produce a cleaner alloy and minimize impurities and oxides
- Lot traceability
- 99.9% and 99.99% purity
- Standard tolerance of ± 0.5% on gold content
- Certificate of analysis provided for each lot and maintained for seven years

Alternative Methods of Using AuSn

Characteristics	Solder Paste	Solder Preform	Evaporation	Alloy Plating	Plating by Layers
Minimum bondline thickness	25.00µm	12.00µm	0.01µm	0.25µm	2.50µm
Cleanliness	Low cleanliness (flux surface contamination)	High cleanliness (when no flux used)	High cleanliness	Good cleanliness (trace of organic impurities only)	Good cleanliness (organic co-deposit impurities)
Deposition equipment	Stencil printer or dispenser	Manual or pick & place	Evaporation chamber	Plating line	Plating line
Device heat exposure	>280°C	>280°C	>Ambient	Ambient	Ambient + diffusion heating step
Strengths	Low-cost equipment; manual or automated assembly; rapid deposition rate	High purity; manual or automated assembly; preforms designed to match deposition footprint	Very high purity; rapid deposition; low-cost equipment; thin to thick layers	Good purity; deposition targeted to conducting surfaces	Good purity; deposition targeted to conducting surfaces
Weaknesses	Flux residue inclusion; thick deposits only; requires diffusion step; requires cleaning; refrigerated storage	Expensive automation equipment; thick depositions only; accurate manual placement difficult, may require flux or reducing atmosphere	Wide area deposition (material loss); may require diffusion step	Expensive equipment; difficult to control composition; low deposition rates	Expensive equipment; difficult to control composition; low deposition rates; requires diffusion step

Factors to consider in using gold-based solders in your process

- Cost per unit and higher yields make it a viable option even though the initial cost will be higher than alternative solders.
- A low oxygen atmosphere may be required if the application is flux free.
- Some applications require pressure to promote good, void-free reflow on horizontal surfaces.
- In step soldering or processes that may require rework, soldering to gold plated surfaces results in an intermetallic that melts at a higher temperature than the original alloy. When using the AuSn alloy, this can be addressed by using high tin-containing alloys.
- Alternative methods, such as scrubbing, forming gas or formic acid, may be needed for oxide removal of the soldered surface.

Soldering Process Options

- **Vacuum soldering**
  - Fluxless, void-free soldering
- **Die-attach**
  - High process temperature
- **Reflow**
  - Convection, infrared, induction
- **Laser soldering**
  - Targeted soldering
- **Vapor phase reflow**
  - Uniform heating
- **Manual Soldering**
  - Solder iron, hot plate, ultra sonic, dipping

Gold Alloy Product Options:

PREFORMS

- Thickness from 0.0127mm (0.0005") and greater
- Tight dimensional tolerances ensure repeatable solder volume
- Flatness measurement capabilities to 0.00254mm (0.0001")
- Large die library with in-house tooling capabilities
- Eutectic alloys are best choices
- Tiny solid shapes from 0.152mm (0.006")

WIRE

- Diameter starting at 0.025mm ± 0.0127mm (0.001" ± 0.0005")
- Tight dimensional tolerances
- Packaging designed to minimize breakage of wire in soldering process
- Maximum of 80% Au

PASTE

- **Powder (80Au/20Sn only)**
  - Type 3 (25-45 microns)
  - Type 4 (15-38 microns)
  - Type 5 (15-25 microns)
  - Type 6 (10-20 microns)
- **No-clean flux**
  - NC-SMQ51SC (used in high-power LED and MEMS)
  - NC-SMQ51A (for difficult to solder surfaces in die-attach)
  - NC-SMQ75 (halogen-free and low-residue; requires <10ppm oxygen)
- **Low-volume packaging**
  - Jars (10g per jar)
  - Syringes (5cc syringes)

SPHERES

- Sizes starting at 0.254mm (0.010")
- Tight dimensional tolerances down to ± 5 microns

Gold-containing solders are an excellent choice with many superior attributes. Cost considerations should be weighed against the high yield, high reliability attributes that make the total cost of ownership attractive.

Locations Worldwide

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

Our Goal

Increase our customers' productivity and profits through premium design, application, and service of 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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