

SPECIALTY SOLDER ALLOYS



Indalloy® Number	Temperature °C (°F)		Elemental Composition (% by Mass)	Density		Electrical Conductivity (172µohms-cm) % of IACS	Thermal Conductivity @ 85°C W/cm-°C	Coefficient of Thermal Expansion @ 20°C PPM/°C	Tensile Strength PSI	Shear Strength PSI	Young's Modulus PSI x106	Elongation %	Brinell Hardness	Latent Heat of Fusion J/g	Specific Heat		Comments
	Liquidus	Solidus		lb/in3	gm/cm3										SOLID J/g-°C	LIQUID J/g-°C	
42	96 (203) E		46.0Bi/34.0Sn/20.0Pb	0.248	8.99	11.7	0.34	20	1720	1630		83.0	4.5 (room T)				Low-temperature eutectic solder. Can be used on the same metalization as SnPb-based solders. Lowest temperature solder paste. Fair wettability on glass, quartz, and many ceramics. Good low-temperature malleability. Compensates for some CTE mismatch. Low vapor pressure.
1E	118 (244) E		52.0In/48.0Sn	0.2637	7.30	4.5	0.19	15	8000	500		55.0 (room T)	23.0 (room T)	44.80	0.167	0.201	Makes a good low-temperature solder paste for electronics assembly. Can be used where Cd and Pb should be avoided. Also good for thermo-electric applications.
281	138 (281) E		58.0Bi/42.0Sn	0.3093	8.56												
282	140 (284)	139 (282)	57.0Bi/42.0Sn/1.0Ag	0.3098	8.57												More malleable and ductile than 281.
290	143 (290) E		97.0In/3.0Ag	0.2666	7.38	23.0	0.73	22	800	2150		58.0	2.0				Has nearly the wettability, thermal conductivity, and low-temperature malleability of In. Solders silver, fired glass, and ceramics. Good for thermal interfaces requiring more creep resistance than pure In.
2	154 (309)	149 (300)	80.0In/15.0Pb/3.0Ag	0.2836	7.85	13.0	0.43	28	2550				5.2 (room T)				Especially useful for soldering to gold because it minimizes leaching. Good thermal fatigue properties.
4	157 (314) MP		100.0In	0.2841	7.31	24.0	0.86	29	273	890	1.57	22.0 to 41.0	0.9	28.47	0.243		Soft, ductile metal has good wettability on many surfaces, including glazed ceramics, certain metallic oxides, glass, and quartz. Bonds to non-metals. Deforms indefinitely under load and has no tendency to become brittle, making it valuable for cryogenic applications. Volume change on freezing -25%.
204	175 (347)	165 (329)	70.0In/30.0Pb	0.2959	8.19	8.8	0.38	28	3460								Minimizes gold leaching characteristics. Good thermal fatigue properties.
Sn63	183 (361) E		63.0Sn/37.0Pb	0.3035	8.40	11.5	0.50	25	7500	6200	4.35	37.0	17.0		0.167		Most widely used SnPb electronic solder. Not recommended for soldering to gold thicker than 0.5 microns (20 micro inches).
227	187 (369)	175 (347)	77.2Sn/20.0In/2.8Ag	0.2619	7.25	9.8	0.54	28	6800	4800	5.80	47.0	17.0				Can be used as a Pb-free replacement for Sn63, Sn62, and Sn60 because it has a similar melting point, as well as equal or superior physical and mechanical properties. Not for use over 100°C due to SnIn eutectic. U.S. patent #5,256,270; covers 78-92%Sn, 1-6%Ag, 4-35%In, temperature range 179-213°C; Solidus: 167-212°C.
7	210 (410)	184 (363)	50.0In/50.0Pb	0.2921	8.86	6.0	0.22	27	4670	2680		55.0	9.6 (room T)				Minimizes gold leaching characteristics. Good thermal fatigue properties. Very good resistance to alkaline corrosion.
241	220 (428)	217 (423)	95.5Sn/3.8Ag/0.7Cu	0.2674	7.40	13.2			6982	3916		36.5	15.0				Pb-free alloy, no patent.
256	220 (428)	217 (423)	96.5Sn/3.0Ag/0.5Cu	0.2674	7.40				7200		2.41	19.3					Pb-free alloy, no patent. Highly recommend alloy.
121	221 (430) E		96.5Sn/3.5Ag	0.2710	7.50	16.0	0.33	30	5800	2700	2.60	73.0	40.0				Pb-free, high-temperature solder. Excellent thermal fatigue properties. Not recommended for soldering to gold thicker than 0.5 microns (20 micro inches).
246	225 (437)	217 (423)	95.5Sn/4.0Ag/0.5Cu	0.2674	7.40				7470			17.3					Pb-free alloy, no patent. See Indalloy® 256.
206	231 (448)	197 (387)	60.0Pb/40.0In	0.3360	9.30	5.2	0.19	26	5000								Minimizes gold leaching characteristics. Good thermal fatigue properties.
209	233 (451) E		65.0Sn/75.0Ag/10.0Sn	0.2818	7.80				17000								Pb-free, good wetting, high performance solder. Melting points too low for use with Pb-free solders used to attach the devices to the board.
3	237 (459)	143 (289)	90.0In/10.0Ag	0.2724	7.54	22.1	0.67	15	1650	1600		61.0	2.7 (room T)				Has nearly the wettability and low-temperature malleability of In. Solders silver, fired glass, and ceramics. Large plastic range.
133	240 (464)	235 (455)	95.0Sn/5.0Sn/5.0Ag	0.2619	7.25	11.9	0.28	31	5900	6000		38.0	13.3				Pb-free, used in food equipment, potable water systems, and refrigeration tubing. Good wettability and creep resistance.
233	255 (491)	245 (473)	85.0Pb/10.0Sn/5.0Sn	0.3743	10.36	6.0			5570			3.5		0.90	0.150		Used in step soldering.
182	280 (536) E		80.0Au/20.0Sn	0.5242	14.51		0.57	16	40000	40000	8.57	2.0			0.150		Very strong solder with excellent thermal fatigue resistance. Excellent solder to use when soldering to gold. High thermal conductivity.
228	290 (554)	267 (513)	86.0Pb/10.0Sn/2.0Ag	0.3884	10.75	8.5	0.27	29	3260			42.0			0.143		Not recommended for applications above 120°C due to formation of eutectic.
151	296 (565)	267 (516)	92.5Pb/5.0Sn/2.5Ag	0.3882	11.02	8.6			4210	2240	2.00				0.130		Ag increases the performance without a large decrease in wetting.
159	302 (576)	275 (527)	90.0Pb/10.0Sn	0.3884	10.75	8.9	0.25	29	4400	2400	2.76	30.0	10.0				Easy to use since it wets well, but very low thermal cycling performance.
163	304 (579)	289 (570)	95.5Pb/2.5Ag/2.0Sn	0.4047	11.20												Good for soft solder die-attach. Poor wetting, but good thermal cycle performance due to low Sn content.
164	310 (590)	300 (572)	92.5Pb/5.0In/2.5 Ag	0.3882	11.02	5.5	0.25	25	4580	2830							Good thermal fatigue. Minimal gold leaching properties of InPb alloys. Often used in reducing atmospheres such as 88% nitrogen 12% hydrogen.
171	312 (594)	308 (596)	95.0Pb/5.0Sn	0.3896	11.06	8.8	0.23	30	4000	2100		45.0	8.0 (room T)				High-temperature SnPb alloy.
183	356 (673) E		86.0Au/12.0Ge	0.5300	14.67		0.44	13	28835	26825	10.55						Die-attach alloy.
184	363 (686) E		96.8Au/3.2Sn	0.5564	15.40		0.27	12	38675	31900	12.04						Die-attach alloy.

Notes:
 note 1: Brinell hardness, 2mm ball, 4kg load
 note 2: Modified Brinell hardness, using 100kg load, 1/2 min.
 note 3: % elongation on 50x (sq. root area) gauge length

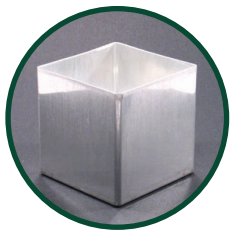
SPECIALTY SOLDER ALLOYS

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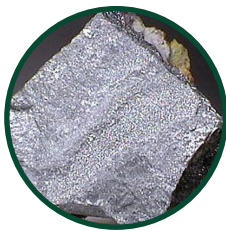
Atomic Number — 49
Element Name — Indium
Element Symbol — In
Relative Atomic Mass — 114.818

Semimetal Nonmetal
Halogen Noble Gas
Alkali Metal Alkaline Earth Transition Metal Basic Metal Lanthanide Actinide

1 1A H Hydrogen 1.008	2 2A He Helium 4.003																
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 16.000	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.099	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.972	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 La-Lu Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium 209	85 At Astatine 209	86 Rn Radon 222.018
87 Fr Francium 223	88 Ra Radium 226	89-103 Ac-Lr Actinide Series	104 Rf Rutherfordium 261	105 Db Dubnium 262	106 Sg Seaborgium 266	107 Bh Bohrium 264	108 Hs Hassium 269	109 Mt Meitnerium 268	110 Ds Darmstadtium 289	111 Rg Roentgenium 272	112 Cn Copernicium 277	113 Uut Ununtrium 284	114 Fl Flerovium 289	115 Uup Ununpentium 288	116 Lv Livermorium 293	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown
			57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
			89 Ac Actinium 227	90 Th Thorium 232	91 Pa Protactinium 231	92 U Uranium 238	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 251	99 Es Einsteinium 254	100 Fm Fermium 257	101 Md Mendelevium 258	102 No Nobelium 259	103 Lr Lawrencium 262



Aluminum
Offers good corrosion resistance and good strength when alloyed with Zn or Si.



Antimony
Increases tensile strength of solders. Poor conductor of heat and electricity.



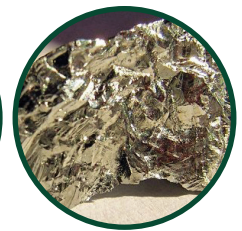
Bismuth
Low melting when alloyed with Sn/Pb or In. Expands 3.32% on solidification. Non-toxic.



Cadmium
Increases corrosion resistance of solders. Increases service temperature and strength of solder.



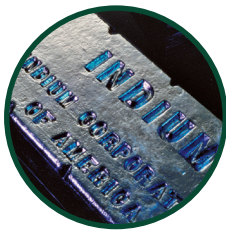
Gallium
Has one of the longest liquid ranges for metals. Has low vapor pressure.



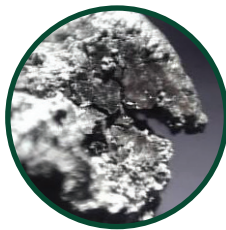
Germanium
When alloyed with Au or Al, will reduce MP and increase strength. Contributes to poor solder wettability.



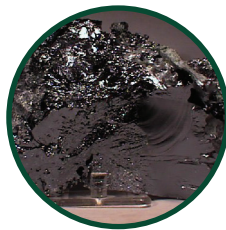
Gold
Highly conductive and corrosion resistant. High melting point is reduced when alloyed with Sn, Si, or Ge.



Indium
Improves wetting of PbAg solders. Resists alkaline corrosion. Bonds glass, quartz, and glazed ceramics.



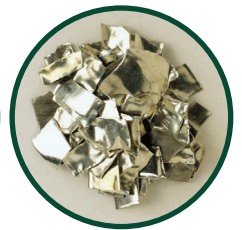
Lead
Economical material, soft and ductile. Offers increased strength when alloyed with other elements. Toxic.



Silicon
When used with Au or Al, will reduce MP, increase strength, and improve wettability.



Silver
Exhibits the highest electrical and thermal conductivity of all metals.



Tin
Excellent wetting characteristics. Low strength alone but when alloyed, becomes stronger.



Contact our engineers: europa@indium.com
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All of Indium Corporation's solder paste and preform manufacturing facilities are IATF 16949:2016 certified. Indium Corporation is an ISO 9001:2015 registered company.

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