APPLICATION NOTE
Physical Constants of Pure Indium

Structure
Crystal structure:
Face Centered Tetragonal at 25°C
a=0.325nm and c=0.494nm

Mass Characteristics
Atomic weight: 114.818

Temperature	Density
20°C	7.300 g/cc
164	7.026
194	7.001
228	6.974
271	6.939
300	6.916

Volume change on freezing: 2.5% contraction

Thermal Properties
Melting point: 156.61°C
Boiling point: 2,080°C
Coefficient of thermal expansion: linear, 24.8µm/m/K at 20°C

Temperature	Specific Heat
25°C	233 J/kg•K
127	252
156.63 (solid)	264
156.63 (liquid)	257
227	256
327	255
427	254

Latent heat of fusion: 28.47kJ/kg
Latent heat of vaporization: 959.42kJ/kg
Thermal conductivity: 83.7W/mK at 0°C

Temperature	Vapor Pressure
1,215°C	0.1013 kPa
1,421	1.0130
1,693	10.1300
2,080	101.3000

Magnetic Properties
Magnetic susceptibility: Volumetric: 7.0 x 10^{-6} (mks or SI)

Electrical Properties
Super conducting at 3.38K:

Temperature	Electrical Resistivity
20°C	84 nΩm
154	291
181	301
222	319
280	348

Electrochemical equivalent: Valence 3, 396.4µg/°C
Electrode potential: $In^{\circ} \rightarrow In^{3+} + 3e^{-}$, 0.38V
Electronegativity: 1.7

Nuclear Properties
Natural isotope distribution:

Mass Number	Natural Isotope Percentage
113	4.3%
115	95.7

Thermal neutron cross section:
For 2.2km/s neutrons: absorption, 190 ± 10b
scattering, 2.2 ± 0.5b
Valences shown: 3, 2, and 1
Atomic radius/Goldschmidt: 0.157 nm
Atomic number: 49
Photoelectric work function: 4.12 eV
Electronic structure: $Kr4d^{10}5s^{2}5p^{1}$
First ionization energy: 133 kcal/gmole

Mechanical Properties

K	Tensile Strength
295 K	1.6 MPa
76	15.0
4	31.9

Compressive strength: 2.14 MPa
Hardness: 0.9HB
Elastic modulus at 20°C: 12.74 GPa in tension
Poisson's ratio at 20°C: 0.4498
Bulk modulus: 35.3 GPa
Tensile modulus: 10.6 GPa

From One Engineer To Another®

INDIUM CORPORATION®

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Typical Indium Applications

Indium, the 49th element, was discovered in Germany in 1863. In 1934, Indium Corporation of America was the first to begin commercial development of indium and is still the leading refiner, fabricator, and marketer of this versatile silver-white metal.

Indium is used in a wide variety of applications, based on its unique attributes.

Soldering

When indium is included in solder alloy compositions, many advantages are realized. Compared to conventional tin-lead solders, indium alloys exhibit lower crack propagation and improved resistance to thermal fatigue. Indium will reduce gold scavenging that can occur with tin-based solder on gold or gold-plated parts. Its ductility will allow some materials with different coefficients of thermal expansion to be joined together.

In spite of the metal's softness, it can strengthen materials it is alloyed with.

Bonding

The unique properties of indium make it an ideal bonding material, especially when bonding to non-metals such as quartz, glass, and glazed ceramics. Indium can also be cold-welded to itself. It easily deforms under pressure and can fill voids between two surfaces, most remarkably down to cryogenic temperatures.

Low-Temperature Alloys

Indium is the basis for many low-melting point fusible alloys. These alloys are often used in work-piece holding and lens-blocking to hold products, such as eyeglass lenses or turbine blades, while the products are being worked on. After processing, the alloy can then be removed with minimal heat, keeping the work-piece or lens from being damaged. Indium is also used with gallium to create liquid metal alloys that are liquid at room temperature.

Thin-Films

Thin-films of indium-tin oxide (ITO) on clear glass or plastic function as transparent electrical conductors and/or infrared reflectors. Typical uses of thin-films of ITO include LCD flat panel displays, touch screen CRTs, EL lamps and displays, EMI shields, solar panels, and energy efficient windows. Aircraft and automobile windshields are coated with ITO for demisting and deicing. Other indium compounds are used in alkaline batteries, replacing toxic mercury compounds.

High-Purity Indium

High-purity indium (99.9999 and 99.99999, or 6N and 7N, respectively) is used in III-V compound semiconductor manufacturing to make InP crystals, which form wafers, the basis of source lasers used in fiber optics in both telecom and datacom applications.

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