INDIUM

(Data in metric tons unless otherwise noted)

Domestic Production and Use: Indium was not recovered from ores in the United States in 2007. Indium-containing zinc concentrates produced in Alaska were exported to Canada for processing. Two companies, one in New York and the other in Rhode Island, produced indium metal and indium products by upgrading lower grade imported indium metal. High-purity indium shapes, alloys, and compounds were also produced from imported indium by several additional firms.

Production of indium tin oxide (ITO) thin-film coatings continued to be the leading end use of indium and accounted for approximately 84% of global indium consumption. ITO thin-film coatings are mostly used for electrically conductive purposes in a variety of flat panel devices—most commonly liquid crystal displays (LCDs). Other end uses included solders and alloys, 8%; compounds, 5%; electrical components and semiconductors, 2%; and research and other, 1%. The estimated value of primary indium metal consumed in 2007, based upon the annual average price, was about $75 million.

Salient Statistics—United States:	2003	2004	2005	2006	2007[e]
Production, refinery	—	—	—	—	—
Imports for consumption[1]	123	143	142	100	116
Exports	NA	NA	NA	NA	NA
Consumption, estimated	90	100	115	125	95
Price, average annual, dollars per kilogram[2]	170	643	827	918	795
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, number	NA	NA	NA	NA	NA
Net import reliance[3] as a percentage of estimated consumption	100	100	100	100	100

Recycling: Data on the quantity of secondary indium recovered from scrap were not available. However, the amount of indium scrap recycled in 2007 was considered small owing to the lack of domestic infrastructure for collecting indium-containing products. Indium recycling could increase significantly in the United States if the current price of indium is sustained or continues to rise. Sputtering, the process in which ITO is deposited as a thin-film coating onto a substrate, is highly inefficient, as only approximately 15% of an ITO sputtering target is deposited onto the substrate. The remainder is scrap. The ITO recycling process takes about 12 weeks from collection of scrap to fabrication of secondary indium products. A recycler may have millions of dollars worth of indium in the recycling loop at any one time. A large increase in ITO scrap could be difficult for the recycling industry to handle because of large capital costs, environmental restrictions, and storage space.

Import Sources (2003-06):[1] China, 45%; Japan, 18%; Canada, 16%; Belgium, 6%; and other, 15%.

Tariff: Item	Number	Normal Trade Relations 12-31-07
Unwrought indium, including powders	8112.92.3000	Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: Global secondary indium production increased significantly during the past several years and now accounts for a greater share of indium production than primary. This trend was expected to continue in the future. In 2007, several major secondary indium producers in Japan and the Republic of Korea announced plans to further increase their recycling capacity. The indium market, however, remained in deficit as demand for the metal, supported largely by ITO demand, continued to outpace supply. In 2007, year-on-year shipments of LCD television panels were forecast to increase 47%, and LCD monitor panels to increase 24%. Mainstream LCD devices were also trending toward larger panel sizes, which require more indium per unit.

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INDIUM

Photovoltaic applications could become another large market opportunity for indium. Thin-film copper indium gallium diselenide (CIGS) solar cells require approximately 50 metric tons of indium to produce 1 gigawatt of solar power. Research was underway to develop a low-cost manufacturing process for flexible CIGS solar cells that would yield high production throughput. Flexible CIGS solar cells could be used in roofing materials and in various applications in the aerospace, military, and recreational industries.

The U.S. producer price for indium began 2007 at $835 per kilogram, where it remained for most of the year. In late September, the price fell to $685 per kilogram.

World Refinery Production, Reserves, and Reserve Base: Definitive data on the economic reserves and resources for indium are not available. Data are revised, based on an estimated average indium content of zinc ores.

	Refinery production		Reserves[4]	Reserve base[4]
	2006	2007[e]		
United States	—	—	280	450
Belgium	30	30	([5])	([5])
Canada	50	50	150	560
China	350	250	8,000	10,000
France	10	10	([5])	([5])
Japan	55	50	—	—
Korea, Republic of	50	85	—	—
Peru	6	6	360	580
Russia	16	17	80	250
Other countries	15	15	1,800	4,200
World total (rounded)	580	510	11,000	16,000

World Resources: Indium's abundance in the continental crust is estimated to be approximately 0.05 parts per million.

Trace amounts of indium occur in base metal sulfides—particularly chalcopyrite, sphalerite, and stannite—by ionic substitution. Indium is most commonly recovered from the zinc-sulfide ore mineral sphalerite. The average indium content of zinc deposits from which it is recovered ranges from less than 1 part per million to 100 parts per million. Although the geochemical properties of indium are such that it occurs with other base metals—copper, lead, and tin—and to a lesser extent with bismuth, cadmium, and silver, most deposits of these metals are subeconomic for indium.

Vein stockwork deposits of tin and tungsten host the highest known concentrations of indium. However, the indium from this type of deposit is usually difficult to process economically. Other major geologic hosts for indium mineralization include volcanic-hosted massive sulfide deposits, sediment-hosted exhalative massive sulfide deposits, polymetallic vein-type deposits, epithermal deposits, active magmatic systems, porphyry copper deposits, and skarn deposits.

Substitutes: Indium has substitutes in many, perhaps most, of its uses; however, the substitutes usually lead to losses in production efficiency or product characteristics. Silicon has largely replaced germanium and indium in transistors. Although more expensive, gallium can be used in some applications as a substitute for indium in several alloys. In glass-coating applications, silver-zinc oxides or tin oxides can be used. Although technically inferior, zinc-tin oxides can be used in LCDs. Another possible substitute for indium glass coating is transparent carbon nanotubes, which are untested in mass production of LCDs. Indium phosphide can be substituted by gallium arsenide in solar cells and in many semiconductor applications. Hafnium can replace indium alloys in nuclear reactor control rods.

[e]Estimated. NA Not available. — Zero.
[1]Imports for consumption of unwrought indium and indium powders (Tariff no. 8112.92.3000).
[2]Indium Corporation's price for 99.97% purity metal; 1-kilogram bar in lots of 10,000 troy ounces. Source: Platts Metals Week.
[3]Defined as imports – exports + adjustments for Government and industry stock changes; exports were assumed to be no greater than the difference between imports and consumption.
[4]See Appendix C for definitions.
[5]Reserves and reserve base for this country are included with "Other countries."