INDIUM

(Data in metric tons unless otherwise noted)

Domestic Production and Use: Indium was not recovered from ores in the United States in 2004. 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.

Thin-film coatings, which are used in applications such as for electroluminescent lamps and for liquid crystal displays (LCDs) in flat panel video screens, continued to be the leading end use. Indium semiconductor compounds were used in infrared detectors, high-speed transistors, and high-efficiency photovoltaic devices. A major manufacturer is testing indium for a new application as a heat-management material in computers, which could increase consumption by 40 metric tons per year. The estimated distribution of uses in 2004 indicated an increase in the application for coatings and electrical components and semiconductors, which was offset by a reduction in the use for solder and alloys and other purposes. Major uses were coatings, 70%; electrical components and semiconductors, 12%; solders and alloys, 12%; and research and other, 6%. The estimated value of primary indium metal consumed in 2004, based upon the annual average price, was about $54 million.

Salient Statistics—United States:	**2000**	**2001**	**2002**	**2003**	**2004**[e]
Production, refinery	—	—	—	—	—
Imports for consumption[1]	69	79	112	118	115
Exports	NA	[e]10	[e]10	NA	NA
Consumption, estimated	55	65	85	90	90
Price, annual average, dollars per kilogram (99.97% indium)	188	120	97	170	600
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, number	NA	NA	NA	NA	NA
Net import reliance[2] as a percentage of estimated consumption	100	100	100	100	100

Recycling: In the United States, only small amounts of indium scrap were recycled in 2004. The reason for the low recycling rate is the lack of infrastructure in the United States for collection of indium-containing products. Recycling of indium could expand significantly in the United States if the current price of indium is sustained or continues to increase. Indium tin oxide (ITO) consumption is highly inefficient, as only about 15% of ITO is consumed to make LCDs; the rest is scrap. The major problem in recycling the ITO scrap is the high cost associated with the process. The 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.

Japan, however, has an aggressive recycling program that makes up for any shortfalls in domestic production and imports of indium. For example, in 2003, about 50% to 60% of Japanese ITO production was from secondary indium, while 10% was recycled from old LCDs. Japanese ITO producers are considering recycling the remaining 30% to 50% of indium that currently is not captured.

Import Sources (2000-03):[1] China, 49%; Canada, 21%; Japan, 9%; France, 6%; and other, 15%.

Tariff: Item	Number	Normal Trade Relations 12-31-04
Unwrought indium, including powder	8112.92.3000	Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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INDIUM

Events, Trends, and Issues: Estimated domestic indium consumption remained the same as that for 2003. Continued strong sales of flat panel displays and other LCD products increased consumption of ITO, mostly in Japan, the Philippines, the Republic of Korea, and Taiwan, well beyond the available production capacity. The report of reduced production from mines that produce byproduct indium and the closure of several smelters because of environmental problems created the perception that supplies of indium from China would decrease, which drove world prices to historic highs. The price dropped briefly in July 2004, but then quickly rebounded. Although the short-range outlook for indium demand remains positive, market supply remains questionable because of its heavy dependence on the strength of the zinc market. With the increasing capacity of ITO refineries and LCD plants in Japan, the Philippines, the Republic of Korea, and Taiwan, and with China opening new ITO refineries and LCD plants, the availability of primary indium feedstock will be further reduced. Recycling efforts, especially in Japan, have done much to offset shortages in supply and to alleviate price pressures.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production[e]		Reserves[3]	Reserve base[3]
	2003	2004		
United States	—	—	300	600
Belgium	40	40	([4])	([4])
Canada	50	50	700	2,000
China	100	110	280	1,300
France	65	10	([4])	([4])
Germany	10	10	NA	NA
Japan	70	70	100	150
Peru	5	5	100	150
Russia	15	15	200	300
Other countries	15	15	800	1,500
World total (rounded)	370	325	2,500	6,000

World Resources: Indium is a rare element and ranks 61st in abundance in the Earth's crust at an estimated 240 parts per billion by weight. This makes it about three times more abundant than silver or mercury.

Indium occurs predominantly in 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 are based on U.S. Department of Commerce, U.S. Treasury, and U.S. International Trade Commission data for unwrought indium and waste and scrap (includes indium powder after 2002).

[2]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.

[3]Estimate based on the indium content of zinc ores. See Appendix C for definitions.

[4]Reserves and reserve base for this country and other European nations are included with "Other countries."