

## INDIUM

(Data in metric tons, unless otherwise noted)

**Domestic Production and Use:** Indium was not recovered from ores in the United States in 2001. Domestically produced standard grade indium was derived from the upgrading of lower grade imported indium metal. Two companies, one each in New York and Rhode Island, were the major producers of indium metal and indium products in 2001. Several firms produced high-purity indium shapes, alloys, and compounds. Thin-film coatings, which are used in applications such as liquid crystal displays (LCDs) and electroluminescent lamps, continued to be the largest end use. Indium semiconductor compounds were used in infrared detectors, high-speed transistors, and high-efficiency photovoltaic devices. The estimated distribution of uses in 2001 indicated a moderate increase in semiconductors and stable consumption in other sectors: coatings, 49%; solders and alloys, 33%; electrical components and semiconductors, 15%; and research and other, 3%. The estimated value of primary indium metal consumed in 2001, based upon the annual average price, was more than \$8.5 million.

<b>Salient Statistics—United States:</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001<sup>e</sup></b>
Production, refinery	—	—	—	—	—
Imports for consumption	85.5	75	77	69	72
Exports	NA	NA	NA	NA	NA
Consumption <sup>e</sup>	50	50	52	55	58
Price, annual average, dollars per kilogram (99.97% indium)	309	296	303	188	147
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, number	NA	NA	NA	NA	NA
Net import reliance <sup>1</sup> as a percentage of estimated consumption	100	100	100	100	95

**Recycling:** Small quantities of old scrap were recycled. Recycling of new scrap, the scrap from fabrication of indium products, is becoming more significant. Recycling occurred previously when the price of indium was relatively very high and/or increasing rapidly. Now it has become a very important part of foreign production, and it is becoming significant in the United States.

**Import Sources (1997-2000):** Canada, 42%; China, 28%; Russia, 10%; France, 10%; and other, 10%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/01</b>
Unwrought, waste and scrap	8112.91.3000	Free.

**Depletion Allowance:** 14% (Domestic and foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** Estimated domestic indium consumption increased modestly to about 58 tons in 2001. The last indium held by the Government stockpile was sold in December 1998. After 3 years of relative stability, the annual average price of indium dropped considerably in 2000 and then remained steady at just under \$150 per kilogram in 2001. Expanding LCD manufacture kept demand strong for indium-tin oxide, while the use of indium phosphide for optical communications systems increased rapidly. The ready availability of low-priced indium from China—with increases in both capacity and production—kept world prices down. The long range outlook for the indium market remains promising despite possible near term market fluctuations caused by economic uncertainties.

### **World Refinery Production, Reserves, and Reserve Base:**

	Refinery production <sup>o</sup>		Reserves <sup>2</sup>	Reserve base <sup>2</sup>
	2000	2001		
United States	—	—	300	600
Belgium	40	40	( <sup>3</sup> )	( <sup>3</sup> )
Canada	45	45	700	2,000
China	95	100	400	1,000
France	65	65	( <sup>3</sup> )	( <sup>3</sup> )
Japan	50	50	100	150
Peru	5	5	100	150
Russia	15	15	200	300
Other countries	20	20	800	1,500
World total (may be rounded)	335	340	2,600	5,700

**World Resources:** Indium occurs predominantly in solid solution in sphalerite, a sulfide ore of zinc. Large quantities of indium also are contained in ores of copper, lead, and tin, but there is not enough information to formulate reliable estimates of indium resources, and most of these deposits are subeconomic for indium. Indium is recovered almost exclusively as a byproduct of zinc. Estimates of the average indium content of the Earth's crust range from 50 to 200 parts per billion. The average indium content of zinc deposits ranges from less than 1 part per million to 100 parts per million. The highest known concentrations of indium occur in vein or replacement sulfide deposits, usually associated with tin-bearing minerals. However, this type of deposit is usually difficult to process economically.

**Substitutes:** Gallium arsenide can substitute for indium phosphide in solar cells and semiconductor applications. Silver-zinc oxide or tin oxide are lower cost substitutes for indium-tin oxide in transparent conductive coatings for glass. Hafnium can replace indium alloys for use in nuclear reactor control rods.

<sup>o</sup>Estimated. NA Not available. — Zero.

<sup>1</sup>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.

<sup>2</sup>Estimate based on the indium content of zinc ores. See Appendix C for definitions.

<sup>3</sup>Reserves for European countries are included in "Other countries."