



2021 Minerals Yearbook

INDIUM [ADVANCE RELEASE]

U.S. Geological Survey, Reston, Virginia: 2025

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INDIUM

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Indium was not recovered from concentrates in the United States during 2021. Several facilities imported indium metal to produce high-purity indium metal, indium compounds, specialty indium alloys, solders, and other indium products. During 2021, U.S. imports for consumption of unwrought indium metal and indium powders were 158 metric tons (t), 37% more than the 115 t imported in 2020 (table 1). There was no exclusive export trade code for indium. Global primary refined indium production was estimated to have decreased by 3% in 2021 to 932 t from 958 t (revised) in 2020 (table 3).

Production

Globally, zinc concentrates were the principal source of primary indium. Although the United States was a significant producer and exporter of zinc concentrates, no data were available on the indium content in these concentrates.

The West Desert zinc-copper-iron-indium project in Utah continued to progress towards development. In a 2014 preliminary economic assessment, indicated resources at West Desert were 14 million metric tons of ore containing about 440 t of indium. In December, American West Metals Ltd. (Australia) acquired the project from InZinc Mining Ltd. (Canada) and began exploration and infrastructure activities, including a gravity survey, mine design, and a scoping study. A drilling program was scheduled to take place in January 2022 (Dyer and others, 2014, p. 3, 7; American West Metals Ltd., 2021; InZinc Mining Ltd., 2021).

Indium-containing scrap was recycled domestically from indium-containing products such as indium-gallium alloys, indium-tin oxide (ITO), and indium-zinc oxide. Most recycling was done within a manufacturer's facilities as an internal recovery to minimize production losses. Available data were not sufficient to estimate the quantity of indium recovered or recycled into new indium products.

Consumption

Consumption data on indium were not collected by the U.S. Geological Survey. Imported indium metal was upgraded to higher purities and (or) consumed to produce indium alloys, chemicals, shapes, and specialty products, which were sold to downstream users.

Production of ITO was thought to be the leading global use of indium. ITO was used principally as a transparent, electrically conductive, thin-film coating on flat-panel displays—most commonly, liquid crystal displays (LCDs). Globally, a significant amount of indium was reclaimed from spent ITO sputtering targets and reused in the production of new targets.

Indium-containing alloys were commonly used as solders in a wide range of applications owing to indium's high ductility and malleability, high thermal conductivity, and low melting

point. Indium-lead solders were used to inhibit the leaching of gold components in electronic apparatus. Indium-silver alloys or pure indium foil were used as thermal interface materials (a substance used to seal a heat-generating surface to a heat sink, filling microscopic air voids to allow for effective heat transfer) in electronics. Certain indium-tin alloys were used as bonding agents between nonmetallic materials. Indium also was used in dental alloys, in low melting temperature alloys for fuses, as a substitute for mercury, and in white gold alloys.

An important use of indium was for III-V semiconductor materials, most commonly indium phosphide (InP) in optoelectronic devices (such as laser diodes) for fiber-optic communications. InP-based substrates were used in both laser and photo diodes in transceivers and in fifth-generation (5G) fiber-optic telecommunications networks. InP also was expected to be used with gallium arsenide in the development of facial recognition and detection software (Beijing Dimen International Information Consulting Co. Ltd., 2014; Dahlman and others, 2018, p. 57–71).

Indium was used in the manufacturing of copper-indium-gallium diselenide (CIGS) or copper-indium-diselenide (CIS) thin-film solar cells. CIGS and CIS solar cells accounted for a small portion of global photovoltaic (PV) shipments. Most utility-scale PV deployments in the United States used crystalline silicon technology; thin-film cadmium-telluride technology also was widely used (National Renewable Energy Laboratory, 2022a, p. 53; 2022b, p. 23).

Indium also was used to produce the semiconducting compound indium gallium zinc oxide (IGZO) in organic light-emitting diode (OLED) displays and LCDs. IGZO has replaced amorphous silicon as the thin-film transistor in some displays because it allows for more pixels per unit area on small displays and ultra-high definition on large displays. IGZO also requires less voltage to operate (Cammell, 2012; Harrower, 2015, p. 17–19; Roskill's Letter from Japan, 2016).

Prices

The 2021 average Argus Media Group, Argus Metals International free on board U.S. price for indium (minimum 99.99% indium) increased by 39% to \$223 per kilogram in 2021 from \$161 per kilogram in 2020. The price for indium generally increased during 2021, beginning the year at \$188 per kilogram and increasing to \$275 per kilogram by yearend (Argus Metals International, undated).

Foreign Trade

U.S. imports for consumption of unwrought indium metal and indium powders were 158 t in 2021, a 37% increase from the 115 t imported in 2020 (table 1). Leading suppliers in 2021 were the Republic of Korea (51%), Canada (16%), and Peru

(13%). Significant increases in imports from the Republic of Korea (by 41 t) and Peru (21 t) were partially offset by decreases in imports from Japan (by 8 t), China (6 t), Russia (5 t), and Canada (2 t). Data on indium exports were not available because there is no exclusive domestic export Schedule B code for unwrought indium and indium powders, and there is no exclusive Harmonized Tariff Schedule of the United States code at the 6-digit level for analyzing world import statistics.

World Review

Global production of primary indium was estimated to have decreased by 3% in 2021 from that in 2020, mostly because of decreased production in the Republic of Korea (table 3). China continued to be the leading producer, followed by the Republic of Korea, Japan, and Canada. However, most of these production numbers are estimates because reported indium production data are limited or not available.

Primary indium was recovered mainly from the residues generated during the smelting of zinc concentrates. Although an important factor, global changes in zinc mine production may not be an indicator of a corresponding change in the production of indium.

China.—China was the leading producer of refined indium, producing an estimated 540 t in 2021, accounting for 58% of global primary refined production. Production was estimated to have remained essentially unchanged compared with production in 2020.

Hulunbuir Chihong Mining Co. Ltd., a subsidiary of Yunnan Chihong Zinc and Germanium Co. Ltd., began producing crude indium (99.5% indium) in June, according to Chinese news sources (Shanghai Metals Market, 2021).

Several indium producers were reported to have cut production in August to reduce energy use. Guangxi Debang Technology Co., Ltd., a major indium producer in China, reduced its indium production in mid-August to comply with electricity consumption restrictions in the region. The company later ramped up production in the last week of September following the end of the restrictions. The plant was in Liuzhou City, Guangxi Autonomous Region, and had an indium metal production capacity of 120 metric tons per year (t/yr) (Argus Metals International, 2021b). Wenshan Zinc and Indium Smelting Co., Ltd., a subsidiary of Yunnan Tin Co. Ltd., reduced its indium production for an indefinite period beginning in August because of electricity cuts imposed in Yunnan Province. The company's indium metal production capacity was 80 t/yr (Argus Metal International, 2021c). The closings followed warnings issued by the National Development and Reform Commission, China's economic planning agency, to areas of China that exceeded their energy use targets during the first half of the year (Argus Metals International, 2021a).

China continued being a net exporter of indium in 2021, importing 58 t of indium while exporting 511 t of indium. Indium was exported mainly to Hong Kong (49%), the Republic of Korea (36%), Japan (6%), and Germany (3%) (Zen Innovations AG, 2022).

Japan.—In October, Idemitsu Kosan Co. Ltd. (Japan) announced plans to restructure the business of its subsidiary,

Solar Frontier K.K., a leading global manufacturer of CIS thin-film solar cells. As part of the restructuring plan, Solar Frontier would cease producing CIS thin-film solar panels at its Kunitomi Plant at the end of June 2022 and transition to supplying crystalline silicon solar panels. In November, Solar Frontier announced the launch of its monocrystalline silicon solar cell module for residential markets (Idemitsu Kosan Co. Ltd., 2021; Solar Frontier K.K., 2021).

Outlook

World indium consumption is expected to continue to increase with the development of 5G technologies, where InP lasers and receivers are used to send data through fiber-optic lines, providing the “backbone” for wired communications. 5G is used on the backhaul side of telecommunications to provide faster data transfer speeds and allow more efficient calculations of data owing to lower data losses in transmission. Industry projections have estimated the number of devices used on the 5G network in 2019 at 10 million devices with a projected increase to 1.9 billion devices within 5 years. New facilities that produce InP semiconductors are expected in England and India to fulfill the expected demand of 5G technologies (Telefonaktiebolaget LM Ericsson, 2019, p. 6).

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TABLE 1
U.S. IMPORTS FOR CONSUMPTION OF UNWROUGHT INDIUM AND INDIUM POWDERS, BY COUNTRY OR LOCALITY¹

Country or locality	2020		2021	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Canada	28,500	\$5,110	26,000	\$5,750
China	13,000	1,940	7,140	1,610
France	7,950	1,170	6,990	1,350
Germany	967	184	95	49
Japan	12,800	2,190	4,890	1,150
Korea, Republic of	39,800	5,800	80,800	14,600
Peru	--	--	20,900	479
Poland	1,080	804	--	--
Russia	7,000	1,030	2,040	368
Singapore	--	--	4,180	762
South Africa	219	42	--	--
Taiwan	3,480	380	4,520	952
United Kingdom	450	20	310	18
Total	115,000	18,700	158,000	27,100

-- Zero.

¹Table includes data available through June 7, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau. Harmonized Tariff Schedule of the United States code 8112.92.3000.

TABLE 2
ESTIMATED WORLD PRIMARY INDIUM PRODUCTION CAPACITY¹

(Metric tons per year)

Country ²	Major operating company	Location of main facilities	Primary annual capacity
Belgium	Umicore NV	Hoboken	50
Canada	Teck Resources Ltd.	Trail, British Columbia	75
China	Guangxi Debang Technology Co., Ltd.	Liuzhou, Guangxi	120
Do.	Guangxi Hechi Jinhe Mining and Smelting Co. Ltd.	Hechi, Guangxi	10
Do.	Guangxi Huaxi Group Co. Ltd.	Laibin, Guangxi	60
Do.	Guangxi Tangshan Zinc & Indium Co. Ltd.	Hechi, Guangxi	30
Do.	Guangxi Yintai Technology Co. Ltd.	Liuzhou, Guangxi	40
Do.	Henan Yuguang Zinc Industry Co. Ltd. (Henan Yuguang Gold and Lead Group Co. Ltd.)	Jiyuan, Henan	38
Do.	Hsikuangshan Twinkling Star Antimony Co. Ltd. (China Minmetals Group)	Lengshuijiang, Hunan	7
Do.	Huludao Nonferrous Metals Group Co.	Huludao, Liaoning	60
Do.	Hulunbuir Chihong Mining Co. Ltd. (Yunnan Chihong Zinc and Germanium Co. Ltd.)	Hulunbuir, Inner Mongolia	NA
Do.	Hunan Jingshi Group Co. Ltd.	Zhuzhou, Hunan	40
Do.	Liuzhou Zinc Products Co.	Liuzhou, Guangxi	20
Do.	Nanjing Germanium Co. Ltd.	Nanjing, Jiangsu	150
Do.	Nanjing Sanyou Electronic Material Co. Ltd.	do.	50
Do.	Shaanxi Zinc Industry Co., Ltd.	Shangluo, Shaanxi	20
Do.	Shenzhen Nonfemet Co.	Shaoquan, Guangdong	25
Do.	Tibet Summit Industry Co. Ltd.	Xining, Qinghai	15
Do.	Wenshan Zinc and Indium Smelting Co., Ltd. (Yunnan Tin Co. Ltd.)	Wenshan, Yunnan	80
Do.	Xiangtan Zhengtan Nonferrous Metal Co. Ltd.	Xiangtan, Hunan	75
Do.	Yunnan Chengfeng Nonferrous Metals Co. Ltd.	Gejiu, Yunnan	10
Do.	Yunnan Mengzi Mining and Smelting Co. Ltd.	Honghe, Yunnan	60
Do.	Zhuzhou Hongyilong Industry Co. Ltd.	Zhuzhou, Hunan	96
Do.	Zhuzhou Smelting Group Co. Ltd.	Changning, Hunan	60
France	Nyrstar NV	Auby	48
Japan	Dowa Metals and Mining Co. Ltd.	Iijima, Akita	70
Do.	Mitsui Mining and Smelter Co. Ltd.	Takehara, Hiroshima	NA
Do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo	NA
Korea, Republic of	Korea Zinc Co. Ltd.	Onsan	160
Do.	Young Poong Co., Ltd.	Sukpo	100
Peru	Doe Run Peru S.R. Ltda.	La Oroya	5
Do.	Votorantim Metais Ltda.	Cajamarquilla	50
Russia	Chelyabinsk Zinc Plant OJSC	Chelyabinsk	15
Do.	Ural Mining and Metallurgical Co. ³	Vladikavkaz	--

Do., do. Ditto. NA Not available. -- Zero.

¹Table includes data available through June 7, 2022. Estimated data are rounded to no more than two significant digits.

²Does not represent a complete list of facilities in China; includes facilities that produce crude indium and (or) high-purity indium.

³Ural Mining and Metallurgical Co. closed the Electrozink smelter in Vladikavkaz in 2019.

TABLE 3
INDIUM: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY¹

(Kilograms)

Country or locality ²	2017	2018	2019	2020	2021
Belgium ^e	20,000	22,000	20,000	20,000	20,000
Canada	67,000	65,000 ^e	63,000 ^e	66,000 ^e	60,000 ^e
China	478,000	483,000	534,000 ^e	540,000 ^e	540,000 ^e
France	29,800	46,200	40,000 ^e	38,000 ^e	38,000 ^e
Japan ^e	70,000	70,000	70,000	66,000	66,000
Korea, Republic of ^e	225,000	235,000	225,000	210,000	190,000
Peru ^e	10,000	11,000	12,000	12,000	12,000
Russia ^e	5,000	5,000	5,000	5,000	5,000
Uzbekistan	1,100	800	1,000	1,030	1,000 ^e
Total	906,000 ^r	938,000 ^r	970,000 ^r	958,000 ^r	932,000

^eEstimated. ^rRevised.

¹Table includes data available through May 16, 2022. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the countries and (or) localities listed, Kazakhstan and Ukraine may have produced primary indium, but available information was inadequate to make reliable estimates of output.