GERMANIUM

(Data in kilograms, germanium content, unless otherwise specified)

Domestic Production and Use: In 2023, zinc concentrates containing germanium were produced at mines in Alaska and Tennessee. Some of the germanium-containing concentrates produced in Alaska were exported to a refinery in Canada for processing and germanium recovery in the form of dioxide and tetrachloride. A zinc smelter in Clarksville, TN, produced germanium leach concentrates recovered from processing zinc concentrates from the Middle Tennessee Zinc Complex. Germanium in the form of compounds and metal was imported into the United States for further processing by industry. The value of germanium metal and germanium dioxide (gross weight) imported domestically in 2023 was estimated to be $45 million. A company in Utah produced germanium wafers for the semiconductor industry and for solar cells used in satellites from imported and recycled germanium. A refinery in Oklahoma recovered germanium from scrap and produced germanium tetrachloride for the production of fiber optics.

Salient Statistics—United States:	2019	2020	2021	2022	2023[e]
Production, refinery:					
Primary	—	—	—	—	—
Secondary	NA	NA	NA	NA	NA
Imports for consumption:[e, 1]					
Germanium metal	14,000	14,000	13,000	16,000	24,000
Germanium dioxide	21,000	11,000	17,000	15,000	14,000
Germanium tetrachloride	NA	NA	NA	NA	NA
Exports:[e, 1]					
Germanium metal	3,900	4,000	5,500	6,600	6,300
Germanium dioxide	600	800	400	100	100
Germanium tetrachloride	NA	NA	NA	NA	NA
Shipments from Government stockpile[2]	—	—	—	—	NA
Consumption, estimated[3]	30,000	30,000	30,000	NA	NA
Price, annual average, dollars per kilogram:[4]					
Germanium metal	1,236	1,046	1,187	1,294	1,400
Germanium dioxide	913	724	770	828	880
Net import reliance[5] as a percentage of estimated consumption	>50	>50	>50	>50	>50

Recycling: The United States has the capability to recycle new and old germanium scrap. During the manufacture of infrared germanium optics, much of the germanium removed during the machining process is routinely recycled as new scrap. Infrared lenses and windows in decommissioned military equipment are also recycled to recover germanium. Germanium is recycled from certain wastes generated during the manufacture of optical fibers. Germanium wafers used as substrates to produce solar cells are also recycled. Available information was inadequate to make reliable estimates of the amount of secondary germanium produced.

Import Sources (2019–22):[1, 6] Germanium metal: China, 54%; Belgium, 30%; Germany, 8%; Russia, 6%; and other, 2%. Germanium dioxide: Belgium, 47%; Canada, 46%; and other, 7%. Combined total: Belgium, 39%; China, 26%; Canada, 25%; and other, 10%.

Tariff: Item	Number	Normal Trade Relations 12–31–23
Germanium oxides and zirconium dioxide	2825.60.0000	3.7% ad valorem.
Unspecified chlorides, including germanium tetrachloride	2827.39.9000	3.7% ad valorem.
Metal, unwrought	8112.92.6000	2.6% ad valorem.
Metal, powder	8112.92.6500	4.4% ad valorem.
Metal, wrought	8112.99.1000	4.4% ad valorem.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile:[7]

	FY 2023		FY 2024	
Material	Potential acquisitions	Potential disposals	Potential acquisitions	Potential disposals
Germanium (gross weight)	—	5,000	—	5,000

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GERMANIUM

Events, Trends, and Issues: The major global end uses for germanium were electronics and solar applications, fiber-optic systems, infrared optics, and polymerization catalysts. Other uses included chemotherapy, metallurgy, and phosphors.

U.S. imports of germanium metal and dioxide (germanium content) in 2023 were estimated to have increased by about 20% in 2023 from those in 2022 to 38,000 kilograms. Imports of germanium tetrachloride could not be quantified from available trade data. More than 99% of total imports of metal and dioxide (germanium content) for the year through August were from China, Belgium, Germany, and Canada, in descending order by quantity.

Global germanium refinery production and recycling data were limited, and available estimates were difficult to verify. China continued to be the leading global producer and exporter of germanium in 2023. In August, the Government of China implemented an export licensing program for germanium. Exporters were required to apply for an export license for each shipment of germanium, providing the Government with details on the overseas buyer and end use. Exports of germanium metal (China's export codes 8112.92.10 and 8112.99.10) for the year through September increased by 34% to 34,600 kilograms compared with those in the same period in 2022, despite virtually no exports reported in August and September 2023 after China's export control measures began. These exports were mostly sent to Russia (21%), Germany (19%), Hong Kong (18%), the United States (17%), Belgium (9%), and Japan (8%). Major germanium producers in China included Yunnan Chihong Germanium and Zinc Co. Ltd. and Yunnan Lincang Xinyuan Germanium Industry Co. Ltd.

Germanium metal and germanium dioxide prices (Europe, minimum 99.999% purity) generally rose between January and October with the price for germanium metal increasing from $1,150 per kilogram to $1,550 per kilogram and the price for germanium dioxide increasing from $725 per kilogram to $940 per kilogram.

World Refinery Production and Reserves:[8] Germanium was known to have been produced or recycled commercially in only a few countries, including the United States, Belgium, Canada, China, Germany, and Russia, with China being the leading producer of germanium. Because most producers do not publicly report germanium production, global production data were limited. Substantial germanium-rich deposits, including tailings sites, that were in operation or in active development were in the United States, China, Congo (Kinshasa), and Russia. However, data were generally not available on the reserves of these deposits.

World Resources:[8] Germanium reserves data were not widely reported at a mine or country level and thus difficult to quantify. The available resources of germanium are associated with certain zinc and lead-zinc-copper sulfide ores and lignite coal deposits.

Substitutes: Silicon or gallium arsenide substitute for germanium in certain electronic applications. Some metallic compounds can be substituted in high-frequency electronics applications and in some light-emitting-diode applications. Chalcogenide glass has been used as a substitute for germanium metal in infrared applications. Antimony and titanium are substitutes for use as polymerization catalysts.

[e]Estimated. NA Not available. — Zero.

[1]Data have been adjusted to exclude low-value shipments. Germanium dioxide data were multiplied by 69% to calculate the germanium content.

[2]Defined as change in total inventory from prior yearend inventory. If negative, increase in inventory. Beginning in 2023, Government stock changes no longer available.

[3]Estimated consumption of germanium contained in metal and germanium dioxide.

[4]Average European price for minimum 99.999% purity. Source: Argus Media group, Argus Non-Ferrous Markets.

[5]Defined for 2019–22 as imports – exports ± adjustments for Government stock changes. Beginning in 2023, Government stock changes no longer included.

[6]Germanium metal import sources were based on adjusted data for Harmonized Tariff Schedule of the United States (HTS) codes 8112.92.6000, 8112.92.6500, and 8112.99.1000. Germanium dioxide import sources were based on adjusted data for HTS code 2825.60.0000.

[7]See Appendix B for definitions.

[8]See Appendix C for resource and reserve definitions and information concerning data sources.