

GERMANIUM

(Data in kilograms of germanium content unless otherwise noted)

Domestic Production and Use: Germanium production in the United States comes from either the refining of imported germanium compounds or domestic industry-generated scrap. Germanium for domestic consumption also was obtained from materials imported in chemical form and either directly consumed or consumed in the production of other germanium compounds. Germanium was recovered from zinc concentrates produced at a domestic zinc mine in Alaska. These concentrates were exported to Canada for processing.

A germanium refinery in Utica, NY, produced germanium tetrachloride for optical fiber production. Another refinery in Quapaw, OK, produced refined germanium compounds for the production of fiber optics, infrared devices, and substrates for electronic devices. The major end uses for germanium, worldwide, were estimated to be fiber-optic systems, 30%; infrared optics, 25%; polymerization catalysts, 25%; electronics and solar electric applications, 15%; and other (phosphors, metallurgy, and chemotherapy), 5%. Domestically, the end use distribution was different and was estimated to be infrared optics, 50%; fiber-optic systems, 30%; electronics and solar electric applications, 15%; and other (phosphors, metallurgy, and chemotherapy), 5%. Germanium is not used in polymerization catalysts in the United States. The estimated value of germanium metal consumed in 2012, based on the annual average U.S. producer price, was about \$55 million.

Salient Statistics—United States:	2008	2009	2010	2011	2012^e
Production, refinery ^e	4,600	4,600	3,000	3,000	3,000
Total imports ¹	67,600	60,200	44,700	38,500	49,500
Total exports ¹	17,900	21,200	8,000	5,900	12,800
Shipments from Government stockpile excesses	102	68	—	—	—
Consumption, estimated	54,000	44,000	40,000	36,000	40,000
Price, producer, yearend, dollars per kilogram:					
Zone refined	1,490	940	1,200	1,450	1,680
Dioxide, electronic grade	960	580	720	1,250	1,380
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, plant, ² number ^e	70	70	100	100	100
Net import reliance ³ as a percentage of estimated consumption	90	90	90	90	90

Recycling: Worldwide, about 30% of the total germanium consumed is produced from recycled materials. During the manufacture of most optical devices, more than 60% of the germanium metal used is routinely recycled as new scrap. Germanium scrap was also recovered from the window blanks in decommissioned tanks and other military vehicles.

Import Sources (2008–11):⁴ China, 51%; Belgium, 24%; Russia, 16%; Germany, 6%; and other, 3%.

Tariff: Item	Number	Normal Trade Relations 12–31–12
Germanium oxides	2825.60.0000	3.7% ad val.
Metal, unwrought	8112.92.6000	2.6% ad val.
Metal, powder	8112.92.6500	4.4% ad val.
Metal, wrought	8112.99.1000	4.4% ad val.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: The Defense Logistics Agency, DLA Strategic Materials did not allocate any germanium for sale in the fiscal year 2013 Annual Materials Plan.

Stockpile Status—9–30–12⁵

Material	Uncommitted inventory	Authorized for disposal	Disposal plan FY 2012	Disposals FY 2012
Germanium	16,362	16,362	3,000	—

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Events, Trends, and Issues: Germanium prices were relatively stable during the first quarter of 2012 following increases in 2011. They declined during the late spring and summer months and then increased substantially during the third quarter of the year. Tightness in the global germanium market, particularly for germanium dioxide, pushed prices higher in 2012 compared to those in 2011. This was not necessarily a reflection of significant increases in global germanium consumption but more likely a sign of temporary supply disruptions and speculation of further tightness. Germanium dioxide prices increased by 49% to \$1,375 per kilogram in late September from \$925 per kilogram in mid-March. Factors that contributed to the germanium dioxide price increase included an export tax on germanium dioxide produced in China that tightened global supply, coupled with the shutdown of three Chinese germanium dioxide plants owing to environmental concerns in early 2012. Prices also increased owing to speculation of increased germanium dioxide consumption for use in polymerization catalysts by Japanese beverage bottle manufacturers after the 2011 earthquake and tsunami, and this was partially reflected in a 46% increase in germanium dioxide imports in Japan in 2011 compared with 2010 imports. Japanese consumption of germanium tetrachloride, used in production of fiber-optic cores, increased substantially during the first half of 2012 compared with that of the same period of 2011. In September 2012, China's State Reserve Bureau announced plans to purchase 20 metric tons of germanium metal for its national stockpile. It had not been able to acquire that quantity of germanium as of early October owing to several Chinese germanium plants being closed for installation of environmental protection equipment. Contributing to the perceived supply tightness in the global germanium market, in mid-2012, a leading Chinese germanium dioxide producer entered into an agreement to sell 375 metric tons of germanium dioxide during a 6-year period to a single consumer that specializes in hydro and solar projects.

In the third quarter of 2012, a smelter in Tennessee began to process zinc concentrates from a mine complex in Tennessee into an intermediate germanium concentrate product. Also in 2012, the U.S. germanium tetrachloride producer announced that it had acquired a new manufacturing plant in Rome, NY, to produce gallium-, germanium-, indium-, and tin-based compounds for use in semiconductors, solar cells, and optical fibers. The Oklahoma germanium refiner consolidated global production of germanium blanks for infrared optics to its Quapaw plant. According to leading producers of germanium-related products, consumption of germanium substrates used in light-emitting diodes and solar cells increased during the first half of 2012 compared with that of the same period of 2011. During the same period, consumption of substrates for use in space-based applications declined owing to delays in satellite programs. Cuts in defense spending have reduced consumption of germanium for infrared optical devices for military use; however, more commercial applications for infrared detectors have emerged in recent years.

World Refinery Production and Reserves:

	Refinery production ^e		Reserves ⁶
	2011	2012	
United States	3,000	3,000	450,000
China	80,000	90,000	NA
Russia	5,000	5,000	NA
Other countries	<u>30,000</u>	<u>30,000</u>	<u>NA</u>
World total	118,000	128,000	NA

World Resources: The available resources of germanium are associated with certain zinc and lead-zinc-copper sulfide ores. Significant amounts of germanium are contained in ash and flue dust generated in the combustion of certain coals for power generation. Reserves exclude germanium contained in coal ash.

Substitutes: Silicon can be a less-expensive 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. Zinc selenide and germanium glass substitute for germanium metal in infrared applications systems but often at the expense of performance. Titanium has the potential to be a substitute as a polymerization catalyst.

^eEstimated. NA Not available. — Zero.

¹In addition to the gross weight of wrought and unwrought germanium and waste and scrap that comprise these figures, this series includes estimated germanium content of germanium dioxide. This series does not include germanium tetrachloride and other germanium compounds for which data are not available.

²Employment related to primary germanium refining is indirectly related to zinc refining.

³Defined as imports – exports + adjustments for Government stock changes; rounded to nearest 5%.

⁴Imports are based on the gross weight of wrought and unwrought germanium and waste and scrap, but not germanium tetrachloride and other germanium compounds for which data are not available.

⁵See Appendix B for definitions.

⁶See Appendix C for resource/reserve definitions and information concerning data sources.