

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 two domestic zinc mines, one in Alaska and the other in Washington. These concentrates were exported to Canada for processing. The mine in Washington was placed on temporary care-and-maintenance status in February. A zinc mine complex in Tennessee, which had started producing germanium-rich zinc concentrates in early 2008 and was subsequently closed owing to declining market conditions, resumed operations under new ownership in 2010. There was no indication that any germanium had been recovered from these concentrates in 2010.

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, these end uses varied and were 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 2009, based upon the annual average U.S. producer price, was about \$43 million.

Salient Statistics—United States:	2006	2007	2008	2009	2010^e
Production, refinery ^e	4,600	4,600	4,600	4,600	4,600
Total imports ¹	50,000	52,400	67,600	60,200	60,500
Total exports ¹	12,400	11,700	17,900	21,200	19,500
Shipments from Government stockpile excesses	4,580	6,900	102	68	—
Consumption, estimated	55,000	60,000	54,000	44,000	45,600
Price, producer, yearend, dollars per kilogram:					
Zone refined	950	1,240	1,490	940	940
Dioxide, electronic grade	660	800	960	580	580
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, plant, ² number ^e	65	65	70	70	100
Net import reliance ³ as a percentage of estimated consumption	85	80	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 (2006–09):⁴ Belgium, 36%; China, 34%; Russia, 17%; Germany, 10%; and other, 3%.

Tariff: Item	Number	Normal Trade Relations 12-31-10
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 (formerly Defense National Stockpile Center) continued the Basic Ordering Agreement sales program for germanium using quarterly postings on the DLA Strategic Materials Web site. There were no sales of germanium metal reported during fiscal year 2010.

Stockpile Status—9-30-10⁵

Material	Uncommitted inventory	Authorized for disposal	Disposal plan FY 2010	Disposals FY 2010
Germanium	16,362	16,362	8,000	—

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Events, Trends, and Issues: The global market for germanium metal and germanium dioxide had generally weakened in 2009 and remained relatively unchanged during the first 9 months of 2010. Following steep declines in 2009, the estimated market prices of germanium metal (99.99%) and germanium dioxide were flat during the year, at about \$940 per kilogram and \$580 per kilogram, respectively, by October 2010. Many of the germanium-related exploration and mining projects launched in North America from 2007 to 2008 were suspended or canceled owing to the global economic slowdown and the decline in the zinc market in 2009. Consumption of germanium substrates, used in light-emitting diodes and solar cells, increased during the first half of 2010 compared with that of the same period of 2009. In 2010, a leading domestic producer completed construction of a new germanium substrate manufacturing facility in Oklahoma that was expected to have the capacity to produce about 400,000 substrates per year. The use of germanium substrates in high-efficiency, multijunction solar cells for satellites continued to be a staple of consumption, and more germanium substrates were being used in terrestrial-based solar concentrator systems. Conversely, demand for germanium-based optical blanks for infrared devices declined during the first half of 2010 compared with that in the first half of 2009 owing to a decrease in government purchases. Military and law enforcement agencies continued to be leading consumers of germanium-based infrared devices.

Demand for germanium tetrachloride, used primarily in fiber optics, was relatively flat during the first half of the year. Consumption of germanium dioxide for use in catalysts for polyethylene terephthalate (PET) production, mainly in Japan, declined from that of the previous year owing to increased recycling of catalysts, increased use of substitute antimony-based catalysts, and a reduction in the thickness of PET bottles. Germanium market conditions in China in 2010 were similar to those of the previous year when the economic slowdown reduced demand and prices. Producers were unwilling to drop prices below 2009 levels that had approached their production costs, and consumers were hesitant to agree to long-term purchase contracts. Stocks of germanium held by producers were thought to be elevated in 2010, and a potential impending increase in germanium supply, owing to the completion of a new production facility in Inner Mongolia within the next year, created uncertainty about future market stability. Yunnan Province added germanium to a list of materials that it planned to stockpile in 2010.

A report published by the European Union has identified germanium as 1 of 14 raw materials that are on a list of critical supply concerns for its member countries. The determination was based on each material's level of production, substitutability, and recycling rate, as well as risks associated with the location of supply sources.

A manufacturer developed a new type of phase-change memory chip, using an alloy of antimony, germanium, and titanium that could extend battery life in mobile devices by as much as 20%.

World Refinery Production and Reserves:

	Refinery production ^e		Reserves ⁶
	2009	2010	
United States	4,600	4,600	450,000
China	80,000	80,000	NA
Russia	5,000	5,000	NA
Other countries	30,000	30,000	NA
World total	120,000	120,000	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 dioxide metal content. 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.