GALLIUM

(Data in kilograms of gallium content, unless otherwise noted)

Domestic Production and Use: No domestic primary gallium recovery was reported in 2000. Two companies in Oklahoma and Utah recovered and refined gallium from scrap and impure gallium metal. Imports of gallium, which supplied most of U.S. gallium consumption, were valued at about $15 million. Gallium arsenide (GaAs) components represented about 95% of domestic gallium consumption. About 44% of the gallium consumed was used in optoelectronic devices, which include light-emitting diodes (LED's), laser diodes, photodetectors, and solar cells. Integrated circuits represented 54% of gallium demand. The remaining 2% was used in research and development, specialty alloys, and other applications. Optoelectronic devices were used in areas such as consumer goods, medical equipment, industrial components, telecommunications, and aerospace applications. Integrated circuits were used in defense applications and high-performance computers.

Salient Statistics—United States:	1996	1997	1998	1999	2000[e]
Production, primary	—	—	—	—	—
Imports for consumption	30,000	19,100	26,300	24,100	36,000
Exports	NA	NA	NA	NA	NA
Consumption: Reported	21,900	23,600	26,900	29,800	36,000
Apparent	NA	NA	NA	NA	NA
Price, yearend, dollars per kilogram, 99.99999%-pure	425	595	595	640	640
Stocks, producer, yearend	NA	NA	NA	NA	NA
Employment, refinery, number[e]	20	20	20	20	20
Net import reliance[1] as a percent of apparent consumption	NA	NA	NA	NA	NA

Recycling: Old scrap, none. Substantial quantities of new scrap generated in the manufacture of GaAs-based devices were reprocessed.

Import Sources (1996-99): France, 44%; Russia, 17%; Kazakhstan, 14%; Canada, 6%; and other, 19%.

Tariff: Item	Number	Normal Trade Relations 12/31/00
Gallium metal	8112.91.1000	3.0% ad val.
Gallium arsenide wafers, undoped	2851.00.0010	2.8% ad val.
Gallium arsenide wafers, doped	3818.00.0010	Free.

Depletion Allowance: Not applicable.

Government Stockpile: None.

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Events, Trends, and Issues: Gallium supplies were tight during 2000, resulting in higher prices for crude and refined material. By midyear, spot prices for crude gallium had risen to $600 to $640 per kilogram, which were higher than the price for refined gallium. One producer's price for refined gallium increased to $600 per kilogram from $543 per kilogram in 1999. The increase in demand for gallium mainly resulted from continued growth in the wireless telecommunications industry. GaAs producers in the United States, Europe, and Asia completed some of their previously announced plant expansions and announced plans for additional increases in capacity. Much of this new capacity will have the capability to process 6-inch-diameter wafers, a significant advancement from the industry standard of 4-inch-diameter wafers.

Imports continued to supply almost all U.S. demand for gallium and increased significantly from those in 1999. Using partial-year data, France, Kazakhstan, Russia, and the United Kingdom were the principal U.S. gallium suppliers in 2000.

Consumption of high-purity gallium in Japan also was projected to increase in 2000. Total gallium consumption was projected to increase 30% to 148 metric tons. Domestic production of 14 metric tons, imports of 61 metric tons, and scrap recycling of 73 metric tons were the components of Japanese consumption.

In addition to increased use in wireless communications applications, new gallium-based devices are being developed for the optoelectronic market. White-light LED's, based on gallium technology, have been installed in prototype vehicles as low-beam lights. If these devices are to be used in high-volume applications, improvements in efficiency and reductions in costs are needed. Japanese and U.S. firms continued competing to be the first to successfully commercialize gallium nitride laser diodes and LED's, which have potential markets in laser printers, medical equipment, and digital video recorders.

World Production, Reserves, and Reserve Base: Data on world production of primary gallium were unavailable because data on the output of the few producers were considered to be proprietary. However, in 2000, world primary production was estimated to be about 100 metric tons, with Australia, Germany, Japan, Kazakhstan, and Russia being the largest producers. Countries with smaller output were China, Hungary, Slovakia, and Ukraine. Refined gallium production was estimated to be about 110 metric tons. France was the largest producer of refined gallium, using as feed material crude gallium produced in Australia. Japan and the United States were the other large gallium-refining countries. Gallium was recycled from new scrap in Germany, Japan, the United Kingdom, and the United States.

Gallium occurs in very small concentrations in many rocks and ores of other metals. Most gallium was produced as a byproduct of treating bauxite, and the remainder was produced from zinc-processing residues. Only part of the gallium present in bauxite and zinc ores was recoverable, and the factors controlling the recovery were proprietary. Therefore, a meaningful estimate of current reserves could not be made. The world bauxite reserve base is so large that much of it will not be mined for many decades; hence, most of the gallium in the bauxite reserve base can be considered to have only long-term availability.

World Resources: Assuming that the average content of gallium in bauxite is 50 parts per million (ppm), U.S. bauxite resources, which are mainly subeconomic deposits, contain approximately 15 million kilograms of gallium. About 2 million kilograms of this metal are present in the bauxite deposits in Arkansas. Some domestic zinc ores contain as much as 50 ppm gallium and, as such, could be a significant resource. World resources of gallium in bauxite are estimated to exceed 1 billion kilograms, and a considerable quantity could be present in world zinc reserves. The foregoing estimates apply to total gallium content; only a small percentage of this metal in bauxite and zinc ores is economically recoverable.

Substitutes: Liquid crystals made from organic compounds are used in visual displays as substitutes for LED's. Researchers are also working to develop organic-based LED's that may compete with GaAs in the future. Indium phosphide components can be substituted for GaAs-based infrared laser diodes in some specific-wavelength applications, and GaAs competes with helium-neon lasers in visible laser diode applications. Silicon is the principal competitor for GaAs in solar cell applications. GaAs-based integrated circuits are used in many defense-related applications because of their unique properties, and there are no effective substitutes for GaAs in these applications.

[e]Estimated. NA Not available.

[1]Defined as imports - exports + adjustments for Government and industry stock changes.