GALLIUM

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

Domestic Production and Use: No domestic primary gallium recovery was reported in 1997. 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 $7.0 million. Gallium arsenide (GaAs) components represented about 95% of domestic gallium consumption. About 59% 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 40% of gallium demand. The remaining 1% 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:	1992	1993	1994	1996	1997[e]
Production, primary	—	—	—	—	—
Imports for consumption	15,600	16,900	18,100	30,000	19,000
Exports	NA	NA	NA	NA	NA
Consumption: Reported	11,300	15,500	16,900	21,900	19,000
Apparent	NA	NA	NA	NA	NA
Price, yearend, dollars per kilogram, 99.99999%-pure	425	400	395	425	425
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 (1993-96): France, 50%; Russia, 18%; Canada, 9%; Germany, 8%; and other, 15%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/97	Non-MFN[2] 12/31/97
Gallium metal	8112.91.1000	3.3% ad val.	25.0% ad val.
Gallium arsenide wafers, undoped	2851.00.0010	2.8% ad val.	25.0% ad val.
Gallium arsenide wafers, doped	3818.00.0010	Free	25.0% ad val.

Depletion Allowance: Not applicable.

Government Stockpile: None.

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GALLIUM

Events, Trends, and Issues: Increased demand for GaAs led to decisions by several U.S. firms to increase GaAs production capacity. Construction on new GaAs facilities began in 1996 in Colorado, New Jersey, and Oregon. The New Jersey and Oregon plants were scheduled to be completed in 1997 and the Colorado plant by 1998. The new facilities will have the capability to process 4-inch-diameter wafers, and some of the facilities will be able to be upgraded to process 6-inch-diameter wafers. (The 4-inch wafers are beginning to replace the 3-inch wafers as the industry standard.) Gallium prices were high throughout 1997, with consumers in the United States and Japan reporting prices as high as $400 per kilogram for crude (99.99%-pure) gallium and $600 per kilogram for 99.99999%-pure material.

In May, the largest world gallium producer announced that it would close its 50,000-kilogram-per-year extraction plant in Pinjarra, Western Australia, as a result of a slower-than-expected increase in demand. The company planned to operate its refineries in France and Germany using stockpiled gallium as feed material.

Demand for gallium in Japan was estimated to be 88 metric tons in 1996, with 6% supplied by domestic production, 38% supplied by imports and 56% supplied by recycled material. France and the United States were the principal sources of imported gallium. The 1996 demand was a 23% decline from the 1995 level. Gallium demand is projected to be 100 tons in 1997 if the demand for compound semiconductors increases steadily.

Research continued on developing blue LED's and laser diodes. One U.S. firm began marketing commercial quantities of a blue indium gallium nitride LED. The primary market for the LED is in consumer applications such as stereo equipment and appliances.

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 1997, world primary production was estimated to be about 54,000 kilograms, with Australia and Russia as the largest producers. Countries with smaller output were China, Hungary, Japan, and Slovakia. Refined gallium production was estimated to be about 68,000 kilograms. France was the largest producer of refined gallium, using as feed material crude gallium produced in Australia. Germany and Japan 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. Significant reserves of gallium also occur in oxide minerals derived from surficial weathering of zinc-lead-copper ores. 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. Indium phosphide components can be substituted for GaAs-based infrared laser diodes, and GaAs competes with helium-neon lasers in visible laser diode applications. Silicon is the principal competitor for GaAs in solar cell applications. Because of their enhanced properties, GaAs-based integrated circuits are used in place of silicon in many defense-related applications, 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.

[2]See Appendix B.