

BERYLLIUM

(Data in metric tons of contained beryllium unless otherwise noted)

Domestic Production and Use: One company in Utah mined bertrandite ore and converted it, along with imported beryl, into beryllium hydroxide. Some of the beryllium hydroxide was shipped to the company's plant in Ohio, where it was converted into metal, oxide, and downstream beryllium-copper master alloy, and some was sold. Based on the estimated unit value for beryllium in imported beryllium-copper master alloy, beryllium apparent consumption of 200 tons was valued at about \$120 million. Based on sales revenues, approximately 23% of beryllium products were used in industrial components; 17% each in aerospace and defense applications and in automotive electronics; 12% in consumer electronics; 11% in telecommunications infrastructure; 5% in energy applications; 1% in semiconductor applications; and 14% in other applications. Beryllium alloy strip and bulk products, the most common forms of processed beryllium, were used in all application areas. Most unalloyed beryllium metal and beryllium composite products were used in defense and scientific applications.

Salient Statistics—United States:

| | <u>2017</u> | <u>2018</u> | <u>2019</u> | <u>2020</u> | <u>2021^e</u> |
|--|--------------------|--------------------|--------------------|--------------------|--------------------------------|
| Production, mine shipments | 150 | 165 | 160 | 165 | 170 |
| Imports for consumption ¹ | 60 | 67 | 49 | 48 | 52 |
| Exports ² | 38 | 30 | 37 | 25 | 27 |
| Shipments from Government stockpile ³ | 2 | — | — | 3 | 7 |
| Consumption: | | | | | |
| Apparent ⁴ | 179 | 202 | 167 | 196 | 200 |
| Reported, ore | 160 | 170 | 160 | 170 | 170 |
| Price, annual average unit value, beryllium-copper master alloy, ⁵ dollars per kilogram of contained beryllium | 640 | 590 | 620 | 620 | 610 |
| Stocks, ore, consumer, yearend | 30 | 30 | 35 | 30 | 30 |
| Net import reliance ⁶ as a percentage of apparent consumption | 16 | 18 | 4 | 16 | 16 |

Recycling: Beryllium was recovered from new scrap generated during the manufacture of beryllium products and from old scrap. Detailed data on the quantities of beryllium recycled are not available but may account for as much as 20% to 25% of total beryllium consumption. The leading U.S. beryllium producer established a comprehensive recycling program for all of its beryllium products, recovering approximately 40% of the beryllium content of the new and old beryllium alloy scrap.

Import Sources (2017–20):¹ Kazakhstan, 41%; Japan, 16%; Brazil, 11%; Latvia, 10%; and other, 22%.

| <u>Tariff:</u> | <u>Item</u> | <u>Number</u> | <u>Normal Trade Relations</u> <u>12–31–21</u> |
|-----------------------|---|----------------------|--|
| | Beryllium ores and concentrates | 2617.90.0030 | Free. |
| | Beryllium oxide and hydroxide | 2825.90.1000 | 3.7% ad valorem. |
| | Beryllium-copper master alloy | 7405.00.6030 | Free. |
| | Beryllium-copper plates, sheets, and strip: | | |
| | Thickness of 5 millimeters (mm) or more | 7409.90.1030 | 3.0% ad valorem. |
| | Thickness of less than 5 mm: | | |
| | Width of 500 mm or more | 7409.90.5030 | 1.7% ad valorem. |
| | Width of less than 500 mm | 7409.90.9030 | 3.0% ad valorem. |
| | Beryllium: | | |
| | Unwrought, including powders | 8112.12.0000 | 8.5% ad valorem. |
| | Waste and scrap | 8112.13.0000 | Free. |
| | Other | 8112.19.0000 | 5.5% ad valorem. |

Depletion Allowance: 22% (domestic), 14% (foreign).

BERYLLIUM

Government Stockpile:⁷ The Defense Logistics Agency Strategic Materials had a goal of retaining 47 tons of beryllium metal in the National Defense Stockpile.

| Material | Inventory as of 9–30–21 | FY 2021 | | FY 2022 | |
|--------------------------|------------------------------------|-----------------------------------|--------------------------------|-----------------------------------|--------------------------------|
| | | Potential acquisitions | Potential disposals | Potential acquisitions | Potential disposals |
| Beryl ore (gross weight) | 1 | — | — | — | — |
| Metal (all types) | 57 | — | 7 | — | 7 |
| Structured powder | 7 | — | — | — | — |

Events, Trends, and Issues: Domestic beryllium consumption in 2021 was estimated to be about the same as that of 2020. During the first 6 months of 2021, the leading U.S. beryllium producer reported that net sales of its beryllium alloy strip and bulk products and beryllium metal and composite products were 19% higher than those during the first 6 months of 2020. Net sales of beryllium products increased primarily in the aerospace and defense, automotive, and industrial components markets. As various COVID-19 restrictions were lifted in 2021, it was reported that customer demand increased.

Because of the toxic nature of beryllium, various international, national, and State guidelines and regulations have been established regarding beryllium in air, water, and other media. Industry is required to carefully control the quantity of beryllium dust, fumes, and mists in the workplace.

World Mine Production and Reserves:

| | Mine production^{8, 9} | | Reserves¹⁰ |
|-----------------------|---------------------------------------|-------------------------|--|
| | 2020 | 2021^e | |
| United States | 165 | 170 | The United States has very little beryl that can be economically hand sorted from pegmatite deposits. The Spor Mountain area in Utah, an epithermal deposit, contains a large bertrandite resource, which is being mined. Proven and probable bertrandite reserves in Utah total about 20,000 tons of contained beryllium. World beryllium reserves are not available. |
| Brazil | e3 | 3 | |
| China | 70 | 70 | |
| Madagascar | e1 | 1 | |
| Mozambique | e3 | 3 | |
| Nigeria | e1 | 1 | |
| Rwanda | e1 | 1 | |
| Uganda | 7 | 7 | |
| World total (rounded) | 250 | 260 | |

World Resources:¹⁰ The world's identified resources of beryllium have been estimated to be more than 100,000 tons. About 60% of these resources are in the United States; by tonnage, the Spor Mountain area in Utah, the McCullough Butte area in Nevada, the Black Hills area in South Dakota, the Sierra Blanca area in Texas, the Seward Peninsula in Alaska, and the Gold Hill area in Utah account for most of the total.

Substitutes: Because the cost of beryllium is high compared with that of other materials, it is used in applications in which its properties are crucial. In some applications, certain metal matrix or organic composites, high-strength grades of aluminum, pyrolytic graphite, silicon carbide, steel, or titanium may be substituted for beryllium metal or beryllium composites. Copper alloys containing nickel and silicon, tin, titanium, or other alloying elements or phosphor bronze alloys (copper-tin-phosphorus) may be substituted for beryllium-copper alloys, but these substitutions can result in substantially reduced performance. Aluminum nitride or boron nitride may be substituted for beryllium oxide.

^eEstimated. — Zero.

¹Includes estimated beryllium content of imported ores and concentrates, oxide and hydroxide, unwrought metal (including powders), beryllium articles, waste and scrap, beryllium-copper master alloy, and beryllium-copper plates, sheets, and strip.

²Includes estimated beryllium content of exported unwrought metal (including powders), beryllium articles, and waste and scrap.

³Change in total inventory level from prior yearend inventory.

⁴Defined as production + imports – exports + adjustments for Government and industry stock changes.

⁵Calculated from gross weight and customs value of imports; beryllium content estimated to be 4%. Rounded to two significant figures.

⁶Defined as imports – exports + adjustments for Government and industry stock changes.

⁷See Appendix B for definitions.

⁸In addition to the countries listed, Kazakhstan and Portugal may have produced beryl ore, but available information was inadequate to make reliable estimates of output. Other nations that produced gemstone beryl ore may also have produced some industrial beryl ore.

⁹Based on a beryllium content of 4% from bertrandite and beryl sources.

¹⁰See Appendix C for resource and reserve definitions and information concerning data sources.