

## BERYLLIUM

(Data in metric tons of beryllium content 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 220 tons was valued at about \$110 million. Based on value-added sales revenues, approximately 22% of beryllium products were used in industrial components, 21% in consumer electronics, 16% in automotive electronics, 9% in defense applications, 8% in telecommunications infrastructure, 7% in energy applications, 1% in medical applications, and 16% in other applications. Beryllium alloy strip and bulk products, the most common forms of processed beryllium, were used in all application areas. The majority of unalloyed beryllium metal and beryllium composite products were used in defense and scientific applications.

| <b>Salient Statistics—United States:</b>   | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018<sup>e</sup></b> |
|--|-------------|-------------|-------------|-------------|-------------------------|
| Production, mine shipments   | 270         | 205         | 155         | 150         | 170                     |
| Imports for consumption <sup>1</sup>   | 68          | 66          | 68          | 62          | 86                      |
| Exports <sup>2</sup>   | 26          | 29          | 34          | 38          | 33                      |
| Shipments from Government stockpile <sup>3</sup>   | 1           | 1           | 3           | 2           | —                       |
| Consumption:   |             |             |             |             |                         |
| Apparent <sup>4</sup>  | 318         | 233         | 182         | 181         | 220                     |
| Reported, ore  | 280         | 220         | 160         | 160         | 190                     |
| Unit value, annual average, beryllium-copper master alloy, dollars per kilogram contained beryllium <sup>5</sup> | 470         | 490         | 510         | 640         | 500                     |
| Stocks, ore, consumer, yearend   | 15          | 25          | 35          | 30          | 35                      |
| Net import reliance <sup>6</sup> as a percentage of apparent consumption   | 15          | 12          | 15          | 17          | 22                      |

**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. Beryllium manufactured from recycled sources requires only 20% of the energy as that of beryllium manufactured from primary sources.

**Import Sources (2014–17):**<sup>1</sup> Kazakhstan, 44%; Japan, 14%; Brazil, 7%; United Kingdom, 7%; and other, 28%.

| <b>Tariff: Item</b>                         | <b>Number</b> | <b>Normal Trade Relations<br/>12–31–18</b> |
|---|---------------|--|
| Beryllium ores and concentrates             | 2617.90.0030  | Free.                                      |
| Beryllium oxide and hydroxide               | 2825.90.1000  | 3.7% ad val.                               |
| 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 val.                               |
| Thickness of less than 5 mm:                |               |  |
| Width of 500 mm or more                     | 7409.90.5030  | 1.7% ad val.                               |
| Width of less than 500 mm                   | 7409.90.9030  | 3.0% ad val.                               |
| Beryllium:                                  |               |  |
| Unwrought, including powders                | 8112.12.0000  | 8.5% ad val.                               |
| Waste and scrap                             | 8112.13.0000  | Free.                                      |
| Other                                       | 8112.19.0000  | 5.5% ad val.                               |

**Depletion Allowance:** 22% (Domestic), 14% (Foreign).

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

| Material                 | Inventory<br>As of 9–30–18 | FY2018                    |                                     | FY 2019                   |                                     |
|--------------------------|----------------------------|---------------------------|-------------------------------------|---------------------------|-------------------------------------|
|                          |                            | Potential<br>Acquisitions | Potential<br>Disposals <sup>8</sup> | Potential<br>Acquisitions | Potential<br>Disposals <sup>8</sup> |
| Beryl ore (gross weight) | 1                          | —                         | —                                   | —                         | —                                   |
| Metal                    | 67                         | —                         | 2                                   | —                         | 5                                   |
| Structured powder        | 7                          | —                         | —                                   | —                         | —                                   |

**Events, Trends, and Issues:** In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals (83 FR 23295), including beryllium. This list was developed to serve as an initial focus, pursuant to Executive Order 13817, “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” (82 FR 60835).

Apparent consumption of beryllium-based products was estimated to have increased by about 20% in 2018 from that of 2017. During the first 6 months of 2018, 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 23% higher than those during the first 6 months of 2017. Sales of beryllium products to the consumer electronics, defense, energy, and industrial components markets increased owing to stronger demand.

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:** Reserves for the United States were revised based on updated company information.

|                       | Mine production <sup>e</sup> |      | Reserves <sup>9</sup>  |
|-----------------------|------------------------------|------|--|
|                       | 2017                         | 2018 |  |
| United States         | 150                          | 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 21,000 tons of contained beryllium. World beryllium reserves are not available. |
| Brazil                | 3                            | 3    |  |
| China                 | 50                           | 50   |  |
| Madagascar            | 6                            | 6    |  |
| Nigeria               | 4                            | 4    |  |
| Rwanda                | 1                            | 1    |  |
| World total (rounded) | 210                          | 230  |  |

**World Resources:** 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 size, 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.

<sup>e</sup>Estimated. — Zero.

<sup>1</sup>Includes 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.

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

<sup>3</sup>Change in total inventory level from prior yearend inventory.

<sup>4</sup>Defined as production + net import reliance.

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

<sup>6</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>7</sup>See Appendix B for definitions.

<sup>8</sup>Disposals are defined as any barter, rotation, sale, or upgrade of National Defense Stockpile stock.

<sup>9</sup>See Appendix C for resource and reserve definitions and information concerning data sources.