

## YTTRIUM<sup>1</sup>

[Data in metric tons, yttrium oxide (Y<sub>2</sub>O<sub>3</sub>) equivalent, unless otherwise specified]

**Domestic Production and Use:** Yttrium is one of the rare-earth elements. Bastnaesite (or bastnäsite), a rare-earth fluorocarbonate mineral, was mined in 2024 as a primary product at the Mountain Pass Mine in California, which was restarted in the first quarter of 2018 after being put on care-and-maintenance status in the fourth quarter of 2015. Yttrium was estimated to represent about 0.12% of the rare-earth elements in the Mountain Pass bastnaesite ore. Insufficient information was available to determine the yttrium content of the bastnaesite ore production. Monazite, a rare-earth phosphate mineral, was produced as a separated concentrate that includes yttrium-rich xenotime as part of heavy-mineral-sand concentrates in Florida. There was no fully commercial rare-earth separation facility in the United States, and rare-earth concentrates were exported for processing.

The leading end uses of yttrium were in catalysts, ceramics, electronics, lasers, metallurgy, and phosphors. In ceramic applications, yttrium compounds were used in abrasives, bearings and seals, high-temperature refractories for continuous-casting nozzles, jet-engine coatings, oxygen sensors in automobile engines, and wear-resistant and corrosion-resistant cutting tools. In electronics, yttrium-iron garnets were components in microwave radar to control high-frequency signals. Yttrium was an important component in yttrium-aluminum-garnet laser crystals used in dental and medical surgical procedures, digital communications, distance and temperature sensing, industrial cutting and welding, nonlinear optics, photochemistry, and photoluminescence. In metallurgical applications, yttrium was used as a grain-refining additive and as a deoxidizer. Yttrium was used in heating-element alloys, high-temperature superconductors, and superalloys. Yttrium was used in phosphor compounds for flat-panel displays and various lighting applications.

<b>Salient Statistics—United States:</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024<sup>e</sup></b>
Production, mine	NA	NA	NA	NA	NA
Imports for consumption, yttrium, alloys, compounds, and metal <sup>e, 2</sup>	650	670	1,200	250	470
Exports, compounds <sup>e, 3</sup>	1	9	4	20	<sup>4</sup> 3
Consumption, apparent <sup>e, 5</sup>	600	700	1,000	200	500
Price, average, dollars per kilogram: <sup>6</sup>					
Y <sub>2</sub> O <sub>3</sub> , minimum 99.999% purity	3	6	12	8	6
Yttrium metal, minimum 99.9% purity	34	39	41	33	33
Net import reliance <sup>7, 8</sup> as a percentage of apparent consumption	100	100	100	100	100

**Recycling:** Insignificant.

**Import Sources (2020–23):<sup>9</sup>** Yttrium compounds: China,<sup>10</sup> 93%; Germany, 3%; and other, 4%. Nearly all imports of yttrium metal and compounds are derived from mineral concentrates processed in China. Import sources do not include yttrium contained in value-added intermediates and finished products.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–24</b>
	Rare-earth metals, unspecified:		
	Not alloyed	2805.30.0050	5% ad valorem.
	Alloyed	2805.30.0090	5% ad valorem.
	Mixtures of rare-earth oxides containing yttrium or scandium as the predominant metal	2846.90.2015	Free.
	Mixtures of rare-earth chlorides containing yttrium or scandium as the predominant metal	2846.90.2082	Free.
	Yttrium-bearing materials and compounds containing by weight >19% to <85% Y <sub>2</sub> O <sub>3</sub>	2846.90.4000	Free.
	Other rare-earth compounds, including yttrium and other compounds	2846.90.8090	3.7% ad valorem.

**Depletion Allowance:** Monazite, thorium content, 22% (domestic), 14% (foreign); yttrium, rare-earth content, 14% (domestic and foreign); and xenotime, 14% (domestic and foreign).

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**Government Stockpile:** Not available.

**Events, Trends, and Issues:** China produced most of the world's supply of yttrium from its weathered clay ion-adsorption ore deposits in the southern Provinces—primarily Fujian, Guangdong, and Jiangxi—and from a lesser number of deposits in Guangxi and Hunan. Yttrium also was produced from similar clay deposits in Burma.

Globally, yttrium was mainly consumed in the form of oxide compounds for ceramics and phosphors. Lesser amounts were consumed in electronic devices, lasers, optical glass, and metallurgical applications. In 2024, the average price for  $Y_2O_3$  decreased whereas the average price for yttrium metal remained the same as that in 2023. China's Ministry of Industry and Information Technology raised quotas for rare-earth mining and separation in 2024 to 270,000 tons and 250,000 tons of rare-earth-oxide equivalent, respectively. The yttrium content of the production quota was not specified. Mine production quotas allocated 250,850 tons to light rare earths and 19,150 tons to ion-adsorption clays. In 2024, China exported an estimated 3,100 tons ( $Y_2O_3$  equivalent) of yttrium compounds and metal, and the leading export destinations were, in descending order, Japan, the United States, the Netherlands, and the Republic of Korea.

**World Mine Production and Reserves:**<sup>11</sup> World mine production of  $Y_2O_3$  equivalent contained in rare-earth mineral concentrates was estimated to be 15,000 to 20,000 tons. Most of this production took place in China and Burma. Global reserves of  $Y_2O_3$  were not quantified; however, the leading countries for total rare-earth-oxide reserves included Australia, Brazil, China, India, Russia, and Vietnam. Although mine production in Burma was significant, information on reserves in Burma was not available. Global reserves may be adequate to satisfy near-term demand at current rates of production; however, recent high demand of ion-adsorption clay rare earths in Burma and China as well as changes in economic conditions, environmental issues, or permitting and trade restrictions could affect the availability and pricing of many of the rare-earth elements, including yttrium.

**World Resources:**<sup>11</sup> Large resources of yttrium in monazite and xenotime are available worldwide in placer deposits, carbonatites, uranium ores, and weathered clay deposits (ion-adsorption ore). Additional resources of yttrium occur in apatite-magnetite-bearing rocks, deposits of niobium-tantalum minerals, non-placer monazite-bearing deposits, sedimentary phosphate deposits, and uranium ores.

**Substitutes:** Substitutes for yttrium are available for some applications but generally are much less effective. In most uses, especially in electronics, lasers, and phosphors, yttrium is generally not subject to direct substitution by other elements. As a stabilizer in zirconia ceramics,  $Y_2O_3$  may be substituted with calcium oxide or magnesium oxide, but the substitutes generally impart lower toughness.

<sup>9</sup>Estimated. NA Not available.

<sup>1</sup>See also the Rare Earths chapter; trade data for yttrium are included in the data shown for rare earths.

<sup>2</sup>Estimated from Trade Mining LLC shipping records.

<sup>3</sup>Includes data for the following Schedule B number: 2846.90.2015.

<sup>4</sup>Data adjusted by the U.S. Geological Survey to exclude low-value shipments. The U.S. Census Bureau reported 731,000 metric tons of exports through September 2024.

<sup>5</sup>Defined as imports – exports. Rounded to one significant digit. Yttrium consumed domestically was imported or refined from imported materials.

<sup>6</sup>Free on board China. Source: Argus Media Group, Argus Rare Earths.

<sup>7</sup>Defined as imports – exports.

<sup>8</sup>Domestic production of mineral concentrates was stockpiled or exported. Consumers of compounds and metals were reliant on imports and stockpiled inventory of compounds and metals.

<sup>9</sup>Includes estimated  $Y_2O_3$  equivalent from the following Harmonized Tariff Schedule of the United States codes: 2846.90.2015, 2846.90.2082, 2846.90.4000, 2846.90.8050, and 2846.90.8060 (2020–21); and 2846.90.8075 and 2846.90.8090 (2022–23).

<sup>10</sup>Includes Hong Kong.

<sup>11</sup>See Appendix C for resource and reserve definitions and information concerning data sources.