YTTRIUM[1]

[Data in metric tons, yttrium oxide (Y_2O_3) 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 2023 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 the heavy-mineral concentrate. Both are accessory minerals in heavy-mineral-sand concentrates. There is 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.

Salient Statistics—United States:	**2019**	**2020**	**2021**	**2022**	**2023[e]**
Production, mine	NA	NA	NA	NA	NA
Imports for consumption, yttrium, alloys, compounds, and metal[e, 2]	360	650	670	1,200	250
Exports, compounds[e, 3]	6	1	9	4	23
Consumption, apparent[e, 4]	400	600	700	1,000	200
Price, average, dollars per kilogram:[5]					
Y_2O_3, minimum 99.999% purity	3	3	6	12	8
Yttrium metal, minimum 99.9% purity	34	34	39	41	33
Net import reliance[6, 7] as a percentage of apparent consumption	100	100	100	100	100

Recycling: Insignificant.

Import Sources (2019–22):[8] Yttrium compounds: China,[9] 94%; Germany, 2%; France, 1%; Republic of Korea, 1%; and other, 2%. 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.

Tariff: Item	Number	Normal Trade Relations 12–31–23
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_2O_3	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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YTTRIUM

<u>Government Stockpile</u>:[10] Not available.

<u>Events, Trends, and Issues</u>: 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 2023, the average prices for yttrium metal and Y_2O_3 each decreased compared with those in 2022. China's Ministry of Industry and Information Technology raised quotas in 2023 for rare-earth mining and separation to 240,000 tons and 230,000 tons of rare-earth-oxide equivalent, respectively. The yttrium content of the production quota was not specified. Mine production quotas allocated 220,850 tons to light rare earths and 19,150 tons to ion-adsorption clays.

In 2023, China's exports of yttrium compounds and metal were estimated to be 2,900 tons of Y_2O_3 equivalent, and the leading export destinations were, in descending order, Japan, Italy, the United States, and the Republic of Korea. In 2022, China's exports of yttrium compounds and metal were 3,400 tons of Y_2O_3 equivalent.

<u>World Mine Production and Reserves</u>:[11] World mine production of yttrium contained in rare-earth mineral concentrates was estimated to be 10,000 to 15,000 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, 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.

<u>World Resources</u>:[11] 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.

<u>Substitutes</u>: 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.

[e]Estimated. NA Not available.
[1]See also the Rare Earths chapter; trade data for yttrium are included in the data shown for rare earths.
[2]Estimated from USATrade, Trade Mining LLC, and Zen Innovations shipping records.
[3]Includes data for the following Schedule B code: 2846.90.2015.
[4]Defined as imports – exports. Rounded to one significant digit. Yttrium consumed domestically was imported or refined from imported materials.
[5]Free on board China. Source: Argus Media group, Argus Rare Earths.
[6]Defined as imports – exports.
[7]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.
[8]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 (2019–21); and 2846.90.8075 and 2846.90.8090 (2022).
[9]Includes Hong Kong.
[10]See Appendix B for definitions.
[11]See Appendix C for resource and reserve definitions and information concerning data sources.