

YTTRIUM¹

[Data in metric tons of yttrium oxide (Y₂O₃) content unless otherwise noted]

Domestic Production and Use: Rare earths were mined by one U.S. company in 2013. Bastnasite, a rare-earth fluorocarbonate mineral, was mined as a primary product at Mountain Pass, CA. Domestic production of rare-earth oxide mineral concentrate in 2013 was estimated to be 4,000 tons in 2013. Yttrium was estimated to represent 0.12 percent of the rare-earth elements in the Mountain Pass bastnasite ore.

The leading end uses of yttrium, in decreasing order, were in phosphors, ceramics, and metallurgy. Yttrium was used in phosphor compounds for flat panel televisions and displays, and in fluorescent lights. 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 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. 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.

Salient Statistics—United States:	2009	2010	2011	2012	2013^e
Production, mine ²	—	—	—	NA	NA
Imports for consumption:					
Yttrium, alloys, compounds, and metal ^{e, 3}	450	670	550	160	200
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated ⁴	450	670	550	160	200
Price, ⁵ dollars:					
Monazite concentrate, per metric ton ⁵	480	1,700	1,600	660	660
Yttrium oxide, per kilogram, minimum 99.999 purity ⁶	13–14	25–27	136–141	86-91	24-28
Yttrium metal, per kilogram, minimum 99.9% purity ⁶	35–45	50-60	162-172	141-15	61-71
Net import reliance ^{e, 7} as a percentage of apparent consumption	100	100	100	100	100

Recycling: Small quantities, primarily from phosphors.

Import Sources (2009–12): Yttrium compounds, greater than 19% to less than 85% weight percent yttrium oxide equivalent: China, 67%; Japan, 15%; Austria, 5%; France, 5%; and other, 8%.

Tariff: Item	Number	Normal Trade Relations 12–31–13
Thorium ores and concentrates (monazite)	2612.20.0000	Free.
Rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed	2805.30.0000	5.0% ad val.
Yttrium-bearing materials and compounds containing by weight >19% to <85% Y ₂ O ₃	2846.90.4000	Free.
Other rare-earth compounds, including yttrium oxide ≥85% Y ₂ O ₃ , yttrium nitrate, and other individual compounds	2846.90.8000	3.7% ad val.

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

Government Stockpile: None.

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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. Processing was primarily at facilities in Guangdong, Jiangsu, and Jiangxi Provinces.

Globally, yttrium was mainly consumed in the form of high-purity oxide compounds for phosphors. Lesser amounts were consumed in ceramics, electronic devices, lasers, and metallurgical applications. Global consumption of yttrium oxide was estimated to be about 7,000 tons. Owing to weak global demand in the phosphor market, prices for yttrium metal and oxide decreased significantly in 2013.

No imports of yttrium-bearing thorium ores and concentrates were reported through July 2013. In 2012, 45 tons of thorium ores and concentrates were imported through Dallas-Fort Worth, TX (17 tons), and Miami, FL (26 tons). The yttrium content of the thorium ores and concentrates was not available.

World Mine Production and Reserves: Mine production of rare-earth oxides in Australia, including yttrium oxide, was estimated to be 3,000 tons in 2012 and 2,000 tons in 2013. The yttrium oxide content of the rare-earth oxides in the Australia's Central Lanthanide deposit was estimated to be 0.76%.

	Mine production ^{e, 8}		Reserves ⁹
	2012	2013	
United States	NA	NA	120,000
Australia	NA	NA	100,000
Brazil	15	15	2,200
China	7,000	7,000	220,000
India	55	56	72,000
Malaysia	2	2	13,000
Sri Lanka	—	—	240
Other countries	—	—	17,000
World total (rounded)	7,100	7,100	540,000

World Resources: The world's resources of yttrium are probably very large. Yttrium is associated with most rare-earth deposits. It occurs in various minerals in differing concentrations and occurs in a wide variety of geologic environments, including alkaline granites and intrusives, carbonatites, hydrothermal deposits, laterites, placers, and vein-type deposits. Although reserves may be sufficient to satisfy near-term demand at current rates of production, economics, environmental issues, and permitting and trade restrictions could affect the mining or availability of many of the rare-earth elements, including yttrium. 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 not subject to substitution by other elements. As a stabilizer in zirconia ceramics, yttria (yttrium oxide) may be substituted with calcia (calcium oxide) or magnesia (magnesium oxide), but the substitutes generally impart lower toughness.

^eEstimated. NA Not available. — Zero.

¹See also Rare Earths; trade data for yttrium are included in the data shown for rare earths.

²Includes yttrium contained in rare-earth ores and mineral concentrates.

³Imports based on data from the Port Import/Export Reporting Service, Journal of Commerce.

⁴Essentially, all yttrium consumed domestically was imported or refined from imported ores and concentrates.

⁵Monazite price estimated based on imports to China.

⁶Free on board China from Metal-Pages Ltd., Teddington, United Kingdom.

⁷Defined as imports – exports + adjustments for Government and industry stock changes. Insufficient data were available to determine exports and stocks changes and were excluded from the calculation.

⁸Includes yttrium contained in rare-earth ores.

⁹[See Appendix C for resource/reserve definitions and information concerning data sources.](#)