YTTRIUM[1]

(Data in metric tons of yttrium oxide (Y_2O_3) content, unless otherwise noted)

Domestic Production and Use: The rare-earth element yttrium was mined as a constituent of the mineral bastnasite at Mountain Pass, CA, but was not recovered as a separate element during processing. Bastnasite, a rare-earth fluocarbonate mineral, was mined as a primary product. Bastnasite's yttrium content is very small and represents a potential minor source of the element. Yttrium used by the domestic industry was imported primarily as compounds.

Yttrium was used in many applications. Principal uses were in phosphors used in color televisions and computer monitors, trichromatic fluorescent lights, temperature sensors, and x-ray-intensifying screens. As a stabilizer in zirconia, yttrium was used in abrasives, wear-resistant and corrosion-resistant cutting tools, seals and bearings, high-temperature refractories for continuous-casting nozzles, jet engine coatings, oxygen sensors in automobile engines, and simulant gemstones. 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 industrial cutting and welding, medical and dental surgical procedures, temperature and distance sensing, photoluminescence, photochemistry, digital communications, and nonlinear optics. Yttrium was also used in heating-element alloys, superalloys, and high-temperature superconductors. The approximate distribution in 2000 by end use was as follows: lamp and cathode-ray-tube phosphors, 70%; oxygen sensors, laser crystals, miscellaneous, 17%; ceramics and abrasives, 8%; and alloys, 5%.

Salient Statistics—United States:	1997	1998	1999	2000	2001[e]
Production, mine	—	—	—	—	—
Imports for consumption:					
In monazite (yttrium oxide content[e])	0.22	—	—	—	—
Yttrium compounds, greater than 19% to less than 85% oxide equivalent (gross weight)	48	107	268	97	69
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated[2]	292	516	428	454	400
Price, dollars:					
Monazite concentrate, per metric ton[3]	400	400	400	400	400
Yttrium oxide, per kilogram, 99.0% to 99.99% purity[4]	17-85	22-85	22-85	25-200	22-88
Yttrium metal, per kilogram, 99.0% to 99.9% purity[4]	80-100	80-100	80-100	95-115	95-115
Stocks, processor, yearend	NA	NA	NA	NA	NA
Net import reliance[e 5] as a percentage of apparent consumption	100	100	100	100	100

Recycling: Small quantities, primarily from laser crystals and synthetic garnets.

Import Sources (1997-2000):[e] Yttrium compounds, >19% to < 85% weight percent yttrium oxide equivalent: China, 69%; France, 21%; Japan, 4%; Germany, 2%; and other, 4%. Import sources based on Journal of Commerce data (year 2000 only): China, 74%; Japan, 22%; United Kingdom, 3%; and Germany, 1%.

Tariff: Item	Number	Normal Trade Relations 12/31/01
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_2O_3	2846.90.4000	Free.
Rare-earth compounds, including yttrium oxide, 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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YTTRIUM

Events, Trends, and Issues: Yttrium demand in the United States increased in 2000 and declined slightly in 2001 as the U.S. economy experienced a recessionary period. International yttrium markets continued to be competitive, although China was the source of most of the world's supply. The decrease in domestic yttrium demand is primarily the result of an overall slow down in the domestic economy and the continued strength of the U.S. dollar against many foreign currencies. Yttrium was consumed primarily in the form of high-purity compounds, especially the oxide and nitrate.

World Mine Production, Reserves, and Reserve Base:

	Mine production[e 6]		Reserves[7]	Reserve base[7]
	2000	2001		
United States	—	—	120,000	130,000
Australia	—	—	100,000	110,000
Brazil	—	—	400	1,500
Canada	—	—	3,300	4,000
China	2,300	2,300	220,000	240,000
India	55	55	36,000	38,000
Malaysia	11	11	13,000	21,000
South Africa	—	—	4,400	5,000
Sri Lanka	2	2	240	260
Thailand	—	—	600	600
Former Soviet Union[8]	26	26	9,000	10,000
World total (rounded)	2,400	2,400	510,000	560,000

World Resources: Large resources of yttrium in monazite and xenotime are available worldwide in ancient and recent placer deposits (monazite and xenotime), weathered clay deposits (ion-adsorption ore), carbonatites, and uranium ores. Additional large subeconomic resources of yttrium occur in other monazite-bearing deposits, apatite-magnetite rocks, sedimentary phosphate deposits, deposits of columbium-tantalum minerals, and certain uranium ores, especially those of the Blind River District in Canada. It is probable that the world's resources are very large.

Substitutes: Substitutes for yttrium are available for some applications, but generally are much less effective. In most uses, especially in phosphors, electronics, and lasers, 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 they generally are not as resilient.

[e]Estimated. NA Not available. — Zero.

[1]See also Rare Earths and Scandium.

[2]Essentially all yttrium consumed domestically was imported or refined from imported ores and concentrates.

[3]Monazite concentrate prices derived from U.S. Census Bureau data (1997-2000).

[4]Yttrium oxide and metal prices from Elements—Rare Earths, Specialty Metals and Applied Technology (a High Tech Materials on-line publication at www.rareearthsmarketplace.com), Rhodia Rare Earths, Inc., Shelton, CT, and the China Rare Earth Information Center, Baotou, China.

[5]Defined as imports - exports + adjustments for Government and industry stock changes.

[6]Includes yttrium contained in rare-earth ores.

[7]See Appendix C for definitions.

[8]As constituted before December 1991.