

YTTRIUM¹

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

Domestic Production and Use: The rare-earth element, yttrium, was mined as a constituent of the mineral bastnasite, but was not recovered as a separate element during processing. Bastnasite, a rare-earth fluorocarbonate mineral, was mined as a primary product at Mountain Pass, CA. 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 1997 by end use was as follows: lamp and cathode ray tube phosphors, 41%; oxygen sensors, laser crystals, and miscellaneous, 38%, ceramics, 21%.

Salient Statistics—United States:	1994	1995	1996	1997	1998^e
Production, mine	W	—	—	—	—
Imports for consumption:					
In monazite (yttrium oxide content ^e)	—	0.44	1.11	0.22	—
Yttrium compounds greater than 19% to less than 85% oxide equivalent (gross weight)	NA	NA	42.2	48.4	130
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated ²	344	365	207	292	450
Price, dollars:					
Monazite concentrate, per metric ton ³	233-272	222-259	244-285	400-400	400-400
Yttrium oxide, per kilogram, 99.0% to 99.99% purity ⁴	20-116	17-110	17-85	17-85	22-85
Yttrium metal, per kilogram, 99.0% to 99.9% purity ⁴	135-350	150-200	95-200	80-100	80-100
Stocks, processor, yearend	NA	NA	NA	NA	NA
Net import reliance ^{e5} as a percent of apparent consumption	100	100	100	100	100

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

Import Sources (1997):^e Yttrium compounds: China, 35%; France, 35%; United Kingdom, 23%; Belgium, 3%; and other, 4%.

Tariff: Item	Number	Normal Trade Relations (NTR) 12/31/98	Non-NTR⁶ 12/31/98
Thorium ores and concentrates (monazite)	2612.20.0000	Free	Free.
Rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed	2805.30.0000	5.0% ad val.	31.3% ad val.
Yttrium bearing materials and compounds containing by weight >19% but <85% Y ₂ O ₃	2846.90.4000	Free	25% ad val.
Rare-earth compounds, including yttrium oxide, yttrium nitrate, and other individual compounds	2846.90.8000	3.7% ad val.	25% ad val.

Depletion Allowance: Percentage method: Monazite: 22% on thorium content and 14% on yttrium and rare-earth content (Domestic), 14% (Foreign). Xenotime: 14% (Domestic and Foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Yttrium demand increased in 1997 and continued strong in 1998 as prices increased. Yttrium markets continued to be competitive, although China was the source of most of the world's supply. The U.S. economy showed a slowdown in the first half of 1998, although imports of yttrium increased. The increase in domestic yttrium demand is primarily the result of U.S. dollar strength and the recessionary Asian economies minimizing inflation and undercutting commodity prices. 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 ⁷		Reserves ⁸	Reserve base ⁸
	1997	1998 ^e		
United States	—	—	120,000	130,000
Australia	—	—	100,000	110,000
Brazil	15	15	400	1,500
Canada	—	—	3,300	4,000
China	2,200	2,200	220,000	240,000
Congo (Kinshasa) ⁹	—	—	570	630
India	30	30	36,000	38,000
Malaysia	4	4	13,000	21,000
South Africa	—	—	4,400	5,000
Sri Lanka	2	2	240	260
Thailand	—	—	600	600
Former Soviet Union ¹⁰	120	120	9,000	10,000
World total (rounded)	2,370	2,370	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 relative to expected demand.

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 may be substituted with calcia or magnesia, but is generally not as resilient.

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹See also Rare Earths and Scandium.

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

³Monazite concentrate prices derived from Metals Bulletin (1994-96) and U.S. Bureau of the Census data (1997).

⁴Yttrium oxide and metal prices from Elements—Rare Earths, Specialty Metals and Applied Technology (a TradeTech publication), Denver, CO, and Rhodia, Inc., Shelton, CT.

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

⁶See Appendix B.

⁷Includes yttrium contained in rare-earth ores.

⁸See Appendix D for definitions.

⁹Formerly Zaire.

¹⁰As constituted before December 1991.