

YTTRIUM¹

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

Domestic Production and Use: The rare-earth element, yttrium, was mined by one company as a constituent of the mineral bastnasite, but was not recovered as a separate element during processing. Bastnasite, a rare-earth fluocarbonate mineral, was mined as a primary product by one company 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 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 1995 by end use was as follows: lamp and cathode ray tube phosphors, 66%; structural ceramics and components, 29%; oxygen sensors, laser crystals, and miscellaneous, 5%.

Salient Statistics—United States:	1992	1993	1994	1995	1996^e
Production, mine	W	W	W	—	—
Imports for consumption:					
In monazite	—	—	—	0.4	—
In xenotime and yttrium concentrate ²	NA	NA	NA	NA	NA
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated	NA	NA	344	365	370
Stocks, processor, yearend	NA	NA	NA	NA	NA
Net import reliance ^{e 3} as a percent of apparent consumption	100	100	100	100	100
Price, dollars: ⁴					
Monazite concentrate, per metric ton	207-241	204-238	233-272	222-259	237-277
Yttrium oxide, per kilogram, 99.0% to 99.99% purity	15-116	16-116	20-116	17-110	17-85
Yttrium metal, per kilogram, 99.0% to 99.9% purity	140-550	135-350	135-350	150-200	95-200

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

Import Sources (1995):^e Yttrium compounds: China, 69%; and Japan, 31%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/96	Non-MFN⁵ 12/31/96
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 1996 as prices were stable to slightly lower. Yttrium markets continued to be competitive, although China was the source of most of the world's supply. The U.S. economy showed strong growth in the first half of 1996, and demand for yttrium in most uses increased.

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 ⁶		Reserves ⁷	Reserve base ⁷
	1995	1996 ⁸		
United States	—	—	120,000	130,000
Australia	—	—	100,000	110,000
Brazil	15	15	400	1,500
Canada	—	—	3,300	4,000
China	1,274	1,300	220,000	240,000
India	55	55	36,000	38,000
Malaysia	8	8	13,000	21,000
South Africa	14	14	4,400	5,000
Sri Lanka	2	2	240	260
Thailand	1	1	600	600
Former Soviet Union ⁸	60	60	9,000	10,000
Zaire	1	1	570	630
World total (rounded)	1,450	1,460	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.

⁶Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹See also Rare-Earths and Scandium.

²This import category typically includes yttrium concentrates.

³Essentially all yttrium consumed domestically was imported or refined from imported ores and concentrates.

⁴Monazite concentrate price derived from Metals Bulletin; yttrium concentrate prices from Industrial Minerals (London); yttrium oxide and metal prices from Elements (a TradeTech publication), Molycorp Inc., and Rhône-Poulenc Basic Chemicals Co.

⁵See Appendix B.

⁶Includes yttrium contained in rare-earth ores.

⁷See Appendix C for definitions.

⁸As constituted before Dec. 1991.