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 not mined in the United States in 2006. All yttrium metal and compounds used in the United States were imported. Principal uses were in phosphors for color televisions and computer monitors, trichromatic fluorescent lights, temperature sensors, and X-ray-intensifying screens. Yttrium also was used as a stabilizer in zirconia, in alumina-zirconia 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 also was used in heating-element alloys, superalloys, and high-temperature superconductors. The approximate distribution in 2005 by end use was as follows: lamp and cathode-ray-tube phosphors, 94%; alloys, 6%; and miscellaneous, <1%.

Salient Statistics—United States:	2002	2003	2004	2005	2006[e]
Production, mine	—	—	—	—	—
Imports for consumption:					
In monazite	—	—	—	—	—
Yttrium, alloys, compounds, and metal[e, 2]	330	380	619	582	600
Exports, in ore and concentrate	NA	NA	NA	NA	NA
Consumption, estimated[3]	330	380	619	582	600
Price, dollars:					
Monazite concentrate, per metric ton[4]	298	275	326	300	300
Yttrium oxide, per kilogram, 99.0% to 99.99% purity[5]	22-88	22-88	22-85	10-85	10-89
Yttrium metal, per kilogram, 99.0% to 99.9% purity[5]	95-115	95-115	96	96	94
Stocks, processor, yearend	NA	NA	NA	NA	NA
Net import reliance[e, 6] as a percentage of apparent consumption	100	100	100	100	100

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

Import Sources (2002-05):[e] Yttrium compounds, >19% to < 85% weight percent yttrium oxide equivalent: China, 91%; Japan, 6%; France, 2%; Austria, 1%; and other, 0.1%. Import sources based on Journal of Commerce data (2005 only): China, 91%; Japan, 3%; Belgium, 3%; Austria, 2%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12-31-06
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.
Other rare-earth compounds, including yttrium oxide ≥ 85% Y_2O_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.

Prepared by **James B. Hedrick [(703) 648-7725, jhedrick@usgs.gov, fax: (703) 648-7757]**

YTTRIUM

Events, Trends, and Issues: Yttrium demand in the United States decreased in 2005 and increased in 2006. The United States required increased amounts for use in various phosphors and in electronics, especially those used in defense applications. Yttrium production and marketing within China continued to be competitive, keeping international prices low, although China was the source of most of the world's supply. Yttrium was consumed primarily in the form of high-purity oxide and nitrate compounds.

World Mine Production, Reserves, and Reserve Base:

	Mine production[e, 7]		Reserves[8]	Reserve base[8]
	2005	2006		
United States	—	—	120,000	130,000
Australia	—	—	100,000	110,000
Brazil	8	8	2,200	6,200
China	6,000	8,800	220,000	240,000
India	55	55	72,000	80,000
Malaysia	15	4	13,000	21,000
Sri Lanka	—	—	240	260
Other	—	—	17,000	20,000
World total (rounded)	6,080	8,900	540,000	610,000

World Resources: Large resources of yttrium in monazite and xenotime are available worldwide in ancient and recent placer deposits, 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 near Elliot Lake, Ontario, Canada. The world's resources are probably very large.

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 they generally have lower toughness.

[e]Estimated. NA Not available. — Zero.
[1]See also Rare Earths.
[2]Imports based on data from the Port Import/Export Reporting Service (PIERS).
[3]Essentially all yttrium consumed domestically was imported or refined from imported ores and concentrates.
[4]Monazite price based on monazite exports from Malaysia for 2002 to 2004 and estimated for 2005 and 2006.
[5]Yttrium oxide and metal prices from Elements—Rare Earths, Specialty Metals and Applied Technology (a High Tech Materials online publication at www.rareearthsmarketplace.com), Rhodia Rare Earths, Inc., Shelton, CT; the China Rare Earth Information Center, Baotou, China; Hefa Rare Earth Canada Co., Ltd., Vancouver, Canada; and Stanford Materials Corp., Aliso Viejo, CA.
[6]Defined as imports – exports + adjustments for Government and industry stock changes.
[7]Includes yttrium contained in rare-earth ores.
[8]See Appendix C for definitions.