

ZIRCONIUM AND HAFNIUM

(Data in metric tons unless otherwise noted)

Domestic Production and Use: The zirconium-silicate mineral zircon is produced as a coproduct from the mining and processing of heavy minerals. Typically, zirconium and hafnium are contained in zircon at a ratio of about 50 to 1. Two firms produced zircon from surface-mining operations in Florida and Virginia. Zirconium metal and hafnium metal were produced from zirconium chemical intermediates by two domestic producers, one in Oregon and the other in Utah. Zirconium chemicals were produced by the metal producer in Oregon and by at least 10 other companies. Ceramics, foundry applications, opacifiers, and refractories are the leading end uses for zircon. Other end uses of zircon include abrasives, chemicals, metal alloys, and welding rod coatings. The leading consumers of zirconium metal and hafnium metal are the nuclear energy and chemical process industries.

Salient Statistics—United States:	2007	2008	2009	2010	2011^e
Production, zircon (ZrO ₂ content)	W	W	W	W	W
Imports:					
Zirconium, ores and concentrates (ZrO ₂ content)	13,000	22,300	9,370	14,900	13,600
Zirconium, unwrought, powder, and waste and scrap	299	318	451	726	648
Zirconium, wrought	485	715	526	435	359
Zirconium oxide ¹	3,740	5,060	2,810	2,920	2,850
Hafnium, unwrought, powder, and waste and scrap	4	12	5	8	12
Exports:					
Zirconium ores and concentrates (ZrO ₂ content)	43,000	27,400	25,700	30,800	15,500
Zirconium, unwrought, powder, and waste and scrap	328	591	223	519	488
Zirconium, wrought	1,830	2,080	2,080	1,540	1,180
Zirconium oxide ¹	2,400	2,970	3,050	5,630	6,250
Consumption, zirconium ores and concentrates, apparent (ZrO ₂ content)	W	W	W	W	W
Prices:					
Zircon, dollars per metric ton (gross weight):					
Domestic ²	763	788	830	860	2,500
Imported, f.o.b. ³	872	773	850	1,155	2,100
Zirconium, unwrought, import, France, dollars per kilogram ⁴	29	41	51	74	64
Hafnium, unwrought, import, France, dollars per kilogram ⁴	246	225	472	453	562
Net import reliance ⁵ as a percentage of apparent consumption:					
Zirconium	E	E	E	E	E
Hafnium	NA	NA	NA	NA	NA

Recycling: In-plant recycled zirconium came from scrap generated during metal production and fabrication and was recycled by companies in Oregon and Utah. Scrap zirconium metal and alloys were recycled by companies in California and Oregon. Zircon foundry mold cores and spent or rejected zirconia refractories are often recycled. Recycling of hafnium metal was insignificant.

Import Sources (2007–10): Zirconium mineral concentrates: Australia, 49%; South Africa, 44%; and other, 7%. Zirconium, unwrought, including powder: Germany, 47%; France, 34%; Japan, 11%; Kazakhstan, 4%; and other, 4%. Hafnium, unwrought: France, 69%; Germany, 17%; United Kingdom, 5%; and other, 9%.

Tariff: Item	Number	Normal Trade Relations
		12-31-11
Zirconium ores and concentrates	2615.10.0000	Free.
Germanium oxides and zirconium dioxide	2825.60.0000	3.7% ad val.
Ferrozirconium	7202.99.1000	4.2% ad val.
Zirconium, unwrought and zirconium powder	8109.20.0000	4.2% ad val.
Zirconium waste and scrap	8109.30.0000	Free.
Other zirconium articles	8109.90.0000	3.7% ad val.
Hafnium, unwrought, powder, and waste and scrap	8112.92.2000	Free.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile: None.

ZIRCONIUM AND HAFNIUM

Events, Trends, and Issues: Domestic production of zirconium mineral concentrates increased compared with that of 2010 and consumption was stable. Domestic mining of heavy minerals continued near Stony Creek, VA, and Starke, FL.

In 2011, increased zircon consumption, primarily in China, resulted in dramatic price increases for zircon. Zircon prices, which began to rise in 2010, reached record-high levels in 2011.

Global production of zirconium concentrates (excluding the United States) increased significantly compared with that of 2010. In the Eucla Basin, Australia, production at the Jacinth-Ambrosia operation was being ramped up to 300,000 tons per year of zircon concentrate. Higher titanium and zirconium mineral prices supported the resumption of mining operations at yearend at Eneabba in Western Australia. In Mozambique, mine production was increasing at the Moma operation to 80,000 tons per year of zircon. In South Africa, a mine tailings treatment plant was commissioned at Richards Bay to recover heavy-mineral concentrates, including zircon, from about 30 years of accumulated mine tailings. Heavy-mineral exploration and mining projects were underway in Australia, Canada, India, Kazakhstan, Kenya, Madagascar, Mozambique, Paraguay, Senegal, South Africa, and the United States.

World Mine Production and Reserves: World primary hafnium production statistics are not available. Hafnium occurs with zirconium in the minerals zircon and baddeleyite. The reserve estimates for Australia and the United States have been revised downward based on new information from Government and company reports. Quantitative estimates of hafnium reserves are not available.

	Zirconium mine production (thousand metric tons)		Zirconium reserves ⁶ (thousand metric tons, ZrO ₂)
	2010	2011 ^e	
United States	W	W	500
Australia	518	720	21,000
Brazil	18	18	2,200
China	140	100	500
India	38	38	3,400
Indonesia	50	50	NA
Mozambique	37	40	1,200
South Africa	400	380	14,000
Ukraine	30	35	4,000
Other countries	14	32	5,000
World total (rounded)	⁷ 1,250	⁷ 1,410	52,000

World Resources: Resources of zircon in the United States included about 14 million tons associated with titanium resources in heavy-mineral sand deposits. Phosphate and sand and gravel deposits have the potential to yield substantial amounts of zircon as a byproduct. Eudialyte and gittinsite are zirconium silicate minerals that have a potential for zirconia production. Identified world resources of zircon exceed 60 million tons.

World resources of hafnium are associated with those of zircon and baddeleyite. Quantitative estimates of hafnium resources are not available.

Substitutes: Chromite and olivine can be used instead of zircon for some foundry applications. Dolomite and spinel refractories can also substitute for zircon in certain high-temperature applications. Niobium (columbium), stainless steel, and tantalum provide limited substitution in nuclear applications, while titanium and synthetic materials may substitute in some chemical processing plant applications.

Silver-cadmium-indium control rods are used in lieu of hafnium at numerous nuclear powerplants. Zirconium can be used interchangeably with hafnium in certain superalloys; in others, only hafnium produces the desired or required grain boundary refinement.

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

¹Includes germanium oxides.

²Yearend average of high-low price range.

³Unit value based on U.S. imports for consumption.

⁴Unit value based on U.S. imports for consumption from France.

⁵Defined as imports – exports.

⁶See Appendix C for resource/reserve definitions and information concerning data sources.

⁷Excludes U.S. production.