

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:	2008	2009	2010	2011	2012^e
Production, zircon (ZrO ₂ content)	W	W	W	W	W
Imports:					
Zirconium, ores and concentrates (ZrO ₂ content)	22,300	9,370	14,900	17,200	26,000
Zirconium, unwrought, powder, and waste and scrap	318	451	727	485	370
Zirconium, wrought	715	526	424	365	280
Zirconium oxide ¹	5,060	2,810	2,920	3,020	5,000
Hafnium, unwrought, powder, and waste and scrap	12	5	8	10	23
Exports:					
Zirconium ores and concentrates (ZrO ₂ content)	27,400	25,700	30,800	15,800	21,000
Zirconium, unwrought, powder, and waste and scrap	591	223	519	675	551
Zirconium, wrought	2,080	2,080	1,540	1,330	1,200
Zirconium oxide ¹	2,970	3,050	5,630	6,710	6,000
Consumption, zirconium ores and concentrates, apparent (ZrO ₂ content)	W	W	W	W	W
Prices:					
Zircon, dollars per metric ton (gross weight):					
Domestic ²	788	830	860	2,650	2,650
Imported, f.o.b. ³	773	850	870	2,500	2,500
Zirconium, unwrought, import, France, dollars per kilogram ⁴	41	51	74	64	110
Hafnium, unwrought, import, France, dollars per kilogram ⁴	225	472	453	544	530
Net import reliance ⁵ as a percentage of apparent consumption:					
Zirconium	E	E	E	NA	NA
Hafnium	NA	NA	NA	NA	NA

Recycling: Companies in Oregon and Utah recycled zirconium from scrap generated during metal production and fabrication. 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. Hafnium metal recycling was insignificant.

Import Sources (2008–11): Zirconium mineral concentrates: Australia, 52%; South Africa, 42%; and other, 6%. Zirconium, unwrought, including powder: Germany, 65%; Kazakhstan, 8%; France, 5%; Japan, 3%; and other, 19%. Hafnium, unwrought: France, 72%; Germany, 14%; United Kingdom, 3%; and other, 11%.

Tariff: Item	Number	Normal Trade Relations 12–31–12
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.

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Events, Trends, and Issues: Domestic production of zirconium mineral concentrates increased compared with that of 2011, and consumption was stable. Domestic mining of heavy minerals continued near Stony Creek, VA, and Starke, FL. Permitting applications were submitted for a new zircon mine in Georgia; construction was planned to begin in early 2013, and production was expected to begin in August 2013, with 16,000 tons per year of zircon production anticipated.

Global production of zirconium concentrates (excluding the United States) decreased significantly compared with that of 2011, in response to weakening demand that began in the final quarter of 2011. Chinese consumption decreased relative to that of 2011 owing to a slowdown in the Chinese economy and resulting slowdown in housing construction, in which zircon is used in ceramic tiles and sanitaryware.

In the Eucla Basin, Australia, zircon production from the Cyclone project was expected to begin in 2015, with production of about 65,000 tons per year expected during a mine life of 10 years. The Lethbridge South Mine on Tiwi Islands was commissioned early in 2012, and a total of 29,000 tons of zircon and rutile was anticipated to be produced by late 2012, but mining was expected to be completed there in 2013. The Kilimiraka project, also on Tiwi Islands, was expected to begin production in 2014 and to have a mine life of 8 to 10 years. In Senegal, the Grande Cote project was expected to produce about 80,000 tons per year of zircon by the end of 2013.

China planned to increase its nuclear power development, which would likely increase demand for nuclear-grade zirconium and hafnium, which are used for nuclear fuel cladding.

World Mine Production and Reserves: World primary hafnium production data are not available. Hafnium occurs with zirconium in the minerals zircon and baddeleyite. Quantitative estimates of hafnium reserves are not available.

	Zirconium mine production (thousand metric tons)		Zirconium reserves ⁶ (thousand metric tons, ZrO ₂)
	2011 ^e	2012 ^e	
United States	W	W	500
Australia	762	610	21,000
China	150	150	500
India	39	40	3,400
Indonesia	130	60	NA
Mozambique	44	47	1,200
South Africa	383	400	14,000
Other countries	110	109	7,200
World total (rounded)	⁷ 1,620	⁷ 1,420	48,000

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 could potentially 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.

^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.