

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:	2009	2010	2011	2012	2013^e
Production, zircon	W	W	W	W	W
Imports:					
Zirconium, ores and concentrates (ZrO ₂ content)	9,370	14,900	17,200	16,700	6,500
Zirconium, unwrought, powder, and waste and scrap	451	727	485	279	484
Zirconium, wrought	526	435	392	289	314
Hafnium, unwrought, powder, and waste and scrap	5	8	10	23	10
Exports:					
Zirconium ores and concentrates (ZrO ₂ content)	25,700	30,800	15,800	13,000	14,200
Zirconium, unwrought, powder, and waste and scrap	223	519	675	555	720
Zirconium, wrought	2,080	1,540	1,330	1,250	1,240
Consumption, zirconium ores and concentrates, apparent (ZrO ₂ content)	W	W	W	W	W
Prices:					
Zircon, dollars per metric ton (gross weight):					
Domestic ¹	830	860	2,650	2,650	2,650
Imported, f.o.b. ²	850	870	2,500	2,075	1,400
Zirconium, unwrought, import, France, dollars per kilogram ³	51	74	64	91	95
Hafnium, unwrought, import, France, dollars per kilogram ³	472	453	544	503	594
Net import reliance ⁴ as a percentage of apparent consumption:					
Zirconium	E	E	<10%	<10%	E
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 (2009–12): Zirconium mineral concentrates: South Africa, 52%; Australia, 43%; and other, 5%. Zirconium, unwrought, including powder: Japan, 43%; Germany, 40%; Kazakhstan, 7%; France, 4%; Canada, 4%; and other, 2%. Hafnium, unwrought: France, 58%; Australia, 24%; Germany, 11%; other, 7%.

Tariff: Item	Number	Normal Trade Relations 12–31–13
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 remained unchanged from that in 2012, although consumption decreased from that in 2012 as reflected by decreased imports. Domestic mining of heavy minerals continued near Stony Creek, VA, and Starke, FL. Construction began at a new zircon mine in Charlton County, GA, and was expected to be completed in the second quarter 2014. A second mine in Brantley County, GA, was expected to come on stream in the first quarter 2015. Construction of a mineral sands plant in Pierce County, GA, to process the heavy minerals from the two new mines, was expected to begin in late 2014.

Global production of zirconium concentrates in 2013 remained at about the same level as that in 2012, despite a weakening demand, particularly in China, resulting from a sharp price increase beginning in late 2011. Globally, several projects were under development that could significantly contribute to global zircon supply. In Kenya, mining at the Kwale project was expected to begin in late 2013. Production of zircon was expected to be 30,000 tons per year during a mine life of 13 years. In South Africa, production at the Tormin project was expected to begin in late 2013 at a rate of 48,000 tons per year of nonmagnetic concentrate grading 81% zircon and 11.6% rutile, with a 4-year mine life. In Senegal, the Grande Cote project was expected to produce about 80,000 tons per year of zircon by the end of 2013, with a mine life of more than 20 years. In New South Wales, Australia, zircon production from the Dubbo Zirconia project was expected to begin in 2016 at a rate of 16,000 tons per year of zircon.

World Mine Production and Reserves: Zirconium reserves for Australia were revised based on a Geoscience Australia publication. Revisions to reserves in Mozambique were based on company reports. 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 ⁵ (thousand metric tons, ZrO ₂)
	2012	2013 ^e	
United States	W	W	500
Australia	605	600	40,000
China	140	140	500
India	40	40	3,400
Indonesia	120	120	NA
Mozambique	47	65	1,100
South Africa	380	360	14,000
Other countries	130	110	7,200
World total (rounded)	⁶ 1,460	⁶ 1,440	67,000

World Resources: Resources of zircon in the United States included about 14 million tons associated with titanium resources in heavy-mineral sand deposits. Phosphate rock and sand and gravel deposits could potentially yield substantial amounts of zircon as a byproduct. 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.

¹ Yearend average of high-low price range.

² Unit value based on U.S. imports for consumption.

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

⁴ Defined as imports – exports.

⁵ [See Appendix C for resource/reserve definitions and information concerning data sources.](#)

⁶ Excludes U.S. production.