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. Two firms produced zircon from surface-mining operations in Florida and Virginia. Zirconium and hafnium metal were produced from zircon by two domestic producers, one in Oregon and the other in Utah. Typically, both elements are in the ore in a zirconium-to-hafnium ratio of about 50:1. Zirconium chemicals were produced by the metal producer in Oregon and by at least 10 other companies. Zirconia (ZrO_2) was produced from zircon at plants in Alabama, New Hampshire, New Jersey, New York, Ohio, Tennessee, and by the metal producer in Oregon. Ceramics, foundry applications, opacifiers, and refractories are the leading end uses for zircon. Other end uses of zircon include abrasives, chemicals, metal alloys, welding rod coatings, and sandblasting. The leading consumers of zirconium and hafnium metal are the nuclear energy and chemical process industries.

Salient Statistics—United States:	**2005**	**2006**	**2007**	**2008**	**2009[e]**
Production, zircon (ZrO_2 content)	W	W	W	W	W
Imports:					
Zirconium, ores and concentrates (ZrO_2 content)	24,800	23,500	13,000	22,300	20,300
Zirconium, unwrought, powder, and waste and scrap	283	256	299	318	690
Zirconium, wrought	741	492	485	715	930
Zirconium oxide[1]	3,160	2,820	3,740	5,060	3,100
Hafnium, unwrought, waste and scrap	4	4	4	12	5
Exports:					
Zirconium ores and concentrates (ZrO_2 content)	65,600	49,600	43,000	27,400	22,000
Zirconium, unwrought, powder, and waste and scrap	321	271	328	591	210
Zirconium, wrought	1,650	1,610	1,830	2,080	2,300
Zirconium oxide[1]	2,260	3,340	2,400	2,970	1,700
Consumption, zirconium ores and concentrates, apparent (ZrO_2 content)	W	W	W	W	W
Prices:					
Zircon, dollars per metric ton (gross weight):					
Domestic[2]	570	785	763	788	830
Imported, f.o.b.[3]	674	791	872	773	890
Zirconium, unwrought, dollars per kilogram[3]	22	23	24	26	58
Hafnium, unwrought, dollars per kilogram[3]	235	194	250	343	648
Net import reliance[4] 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 (2005-08): Zirconium mineral concentrates: Australia, 49%; South Africa, 46%; China, 3%; Russia, 1%; and other, 1%. Zirconium, unwrought, including powder: France, 50%; Germany, 23%; Japan, 12%; Australia, 8%; and other, 7%. Hafnium, unwrought: France, 60%; Germany, 21%; Canada, 8%; United Kingdom, 6%; and other, 5%.

Tariff: Item	**Number**	**Normal Trade Relations 12-31-09**
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, zirconium powders	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, hafnium powders	8112.92.2000	Free.

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

Government Stockpile: None.

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ZIRCONIUM AND HAFNIUM

Events, Trends, and Issues: Domestic consumption of zirconium mineral concentrates decreased significantly compared with that of 2008. Domestic mining of heavy minerals continued near Stony Creek, VA, and Starke, FL. Development of the Brink deposit in Virginia was completed in the first quarter and was expected to extend the economic life of the Virginia operations beyond 2015. In Green Cove Springs, FL, the reprocessing of mine tailings to recover zircon ended in April. In 2009, global financial difficulties led to decreased demand for ceramic, foundry, opacifier, and refractory products. Consequently, the global consumption of zirconium concentrates decreased significantly. In the longer term, however, consumption of zircon was expected to recover with average growth of 3% per year through 2015. Global production of zirconium concentrates (excluding the United States) decreased by 4% compared with that of 2008. Heavy mineral exploration and mining projects were underway in Australia, Canada, India, Kenya, Madagascar, Mozambique, Russia, Senegal, South Africa, and the United States. The availability of hafnium, produced as a byproduct during zirconium metal processing, continued to exceed demand.

Zirconium metal producers were beginning to increase capacity in anticipation of a resurgence of nuclear energy plants. In China, a U.S. zirconium producer formed a joint venture with a Chinese metal producer to build and operate a plant to produce nuclear-grade sponge at Nantong, Jiangsu Province. Production at the Nantong plant was scheduled to begin in 2012, and zirconium sponge was expected to be shipped to China and the United States. Another U.S. zirconium producer was expanding sponge capacity in Albany, OR, to an unspecified level.

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

	Zirconium			Hafnium
	Mine production (thousand metric tons)		Reserves[5] (million metric tons, ZrO_2)	Reserves[5] (thousand metric tons, HfO_2)
	2008	2009[e]		
United States	W	W	3.4	68
Australia	550	510	25	230
Brazil	27	27	2.2	44
China	140	140	0.5	NA
India	30	30	3.4	42
Indonesia	42	42	NA	NA
South Africa	400	395	14	280
Ukraine	35	35	4.0	NA
Other countries	58	48	3.5	NA
World total (rounded)	[6]1,280	[6]1,230	56	660

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 future byproduct. Eudialyte and gittinsite are zirconium silicate minerals that have a potential for zirconia production. Identified world resources of zircon exceed 60 million tons.

Resources of hafnium in the United States are estimated to be about 130,000 tons, available in the 14-million-ton domestic resources of zircon. World resources of hafnium are associated with those of zircon and baddeleyite and exceed 1 million tons.

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 plant uses.

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.

[e]Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.
[1]Includes germanium oxides and zirconium oxides.
[2]Yearend average price.
[3]Unit value based on U.S. imports for consumption.
[4]Defined as imports – exports.
[5]See Appendix C for definitions. Reserve base estimates were discontinued in 2009; see Introduction.
[6]Excludes U.S. production.