

## TITANIUM MINERAL CONCENTRATES<sup>1</sup>

(Data in thousand metric tons of contained TiO<sub>2</sub>, unless otherwise noted)

**Domestic Production and Use:** Two firms produced ilmenite and rutile concentrates from heavy-mineral sands operations in Florida and Virginia, and one firm produced ilmenite in California as a byproduct of sand and gravel production. Domestic production data were withheld to avoid revealing company proprietary data. Based on average prices, the value of titanium mineral concentrates consumed in the United States in 1999 was about \$522 million. The major coproduct of mining from ilmenite and rutile deposits is zircon. About 95% of titanium mineral concentrates were consumed by five titanium pigment producers. The remainder was used in welding rod coatings and for manufacturing metal, carbides, and chemicals.

<b>Salient Statistics—United States:</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999<sup>e</sup></b>
Imports for consumption					
Ilmenite and slag	586	641	651	732	750
Rutile, natural and synthetic	295	305	311	365	305
Exports, <sup>e</sup> all forms	21	10	15	38	6
Consumption					
Ilmenite and slag	1,010	1,010	1,060	<sup>2</sup> 980	<sup>2</sup> 985
Rutile, natural and synthetic	439	365	383	392	380
Price, dollars per metric ton:					
Ilmenite, bulk, 54% TiO <sub>2</sub> , f.o.b. Australian ports	83	87	83	77	91
Rutile, yearend, bulk, f.o.b. Australian ports	600	563	530	500	485
Slag: <sup>e</sup>					
80% TiO <sub>2</sub> , f.o.b. Sorel, Quebec, Canada	244	292	294	338	377
85% TiO <sub>2</sub> , f.o.b. Richards Bay, South Africa	349	353	390	385	393
Stocks, mine, distributor and consumer, yearend <sup>2</sup>					
Ilmenite	137	267	234	248	250
Rutile	52	77	80	70	70
Employment, mine and mill, number <sup>e</sup>	400	400	400	450	450
Net import reliance <sup>3</sup> as a percent of reported consumption	70	57	68	76	77

**Recycling:** None.

**Import Sources (1995-98):** Ilmenite: South Africa, 53%; Australia, 29%; Canada, 6%; India, 6%; and other, 6%. Rutile: Australia, 54%; South Africa, 39%; and other, 7%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/99</b>
Synthetic rutile	2614.00.3000	Free.
Ilmenite and ilmenite sand	2614.00.6020	Free.
Rutile concentrate	2614.00.6040	Free.
Titanium slag	2620.90.5000	Free.

**Depletion Allowance:** Ilmenite and rutile: 23% (Domestic), 15% (Foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** Global production of total ilmenite and slag in 1999 was estimated to be nearly unchanged compared with that of 1998. Similarly, domestic consumption of ilmenite and titanium slag concentrates in 1999 was estimated to be unchanged compared with that of 1998. In 1999, the United States continued its reliance on imported feedstocks with 61% of imports derived from beneficiated ilmenite products.

In the United States, development efforts were proceeding the minerals sands deposits near Camden, TN; a feasibility study was being conducted that included construction of a pilot plant separation facility and the development of a detailed mine plan.

In 1999, two of the largest producers of titanium mineral concentrates merged to form a new company. The merger was estimated to represent 32% of the current supply of titanium feedstock. In Australia, a major new source of ilmenite production was closed after insurmountable operational difficulties. Several companies in Australia were conducting feasibility studies in the Murray Basin. Feasibility studies also continued at the Kwale deposit in Kenya.

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### World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves <sup>4</sup>	Reserve base <sup>4</sup>
	<u>1998</u>	<u>1999<sup>e</sup></u>		
United States:				
Ilmenite	W	W	13,000	59,000
Rutile	W	W	700	1,800
Australia:				
Ilmenite	1,355	1,140	<sup>5</sup> 81,000	<sup>5</sup> 120,000
Rutile	225	180	<sup>5</sup> 17,000	<sup>5</sup> 51,000
Canada, ilmenite <sup>6</sup>	760	770	31,000	36,000
India:				
Ilmenite	162	162	30,000	38,000
Rutile	13	13	6,600	7,700
Norway, ilmenite <sup>6</sup>	266	270	40,000	40,000
South Africa:				
Ilmenite <sup>6</sup>	935	932	63,000	63,000
Rutile	112	112	8,300	8,300
Ukraine:				
Ilmenite	133	133	5,900	13,000
Rutile	48	48	2,500	2,500
Other countries:				
Ilmenite	248	248	63,000	98,000
Rutile	<u>8</u>	<u>8</u>	<u>7,900</u>	<u>100,000</u>
World total (ilmenite, rounded)	<sup>7</sup> 3,860	<sup>7</sup> 3,650	330,000	460,000
World total (rutile, rounded)	<sup>7</sup> 406	<sup>7</sup> 361	43,000	170,000
World total (rounded)	<sup>7</sup> 4,260	<sup>7</sup> 4,010	370,000	640,000

**World Resources:** Ilmenite supplies about 90% of the world's demand for titanium minerals. World ilmenite resources total about 1 billion tons of titanium dioxide. Identified world resources of rutile (including anatase) total about 230 million tons of contained TiO<sub>2</sub>.

**Substitutes:** Ilmenite, rutile, and leucogene are used for producing titanium dioxide pigment, titanium metal, and welding rod coatings. In the future, commercial processes may be developed to use anatase and perovskite mineral concentrates.

Fewer environmental pollution problems are encountered when pigment is produced from rutile rather than ilmenite. The chloride process, using a rutile feed, generates about 0.2 ton of waste per ton of TiO<sub>2</sub> product; the sulfate process, using ilmenite, generates about 3.5 tons of waste per ton of product. Producing synthetic rutile from ilmenite results in about 0.7 ton of waste, mainly iron oxide, per ton of product. Direct chlorination of ilmenite generates about 1.2 tons of waste, mainly ferric chloride, per ton of TiO<sub>2</sub>.

<sup>e</sup>Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>See also Titanium and Titanium Dioxide.

<sup>2</sup>Excludes ilmenite used to produce synthetic rutile.

<sup>3</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>4</sup>See Appendix C for definitions.

<sup>5</sup>Based on data published by the Australian Bureau of Resource Sciences.

<sup>6</sup>Ilmenite is used primarily to produce titaniferous slag. Reserves and reserve base are ilmenite.

<sup>7</sup>Excludes U.S. production.