

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

[Data in thousand metric tons of contained titanium dioxide (TiO<sub>2</sub>) unless otherwise noted]

**Domestic Production and Use:** In 2022, one company recovered ilmenite and rutile concentrates from its surface-mining operations near Nahunta, GA, and Starke, FL. A second company processed existing mine tailings to recover a mixed heavy-mineral concentrate in California. Based on reported data through September, the estimated value of titanium mineral and synthetic concentrates imported into the United States in 2022 was \$780 million. Abrasive sands, monazite, and zircon were coproducts of domestic titanium minerals mining operations. More than 95% of titanium mineral concentrates were consumed by domestic TiO<sub>2</sub> pigment producers. The remainder was used in welding-rod coatings and for manufacturing carbides, chemicals, and titanium metal.

<b>Salient Statistics—United States:</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022<sup>e</sup></b>
Production <sup>2</sup>	100	100	100	100	200
Imports for consumption	1,090	1,160	807	969	950
Exports, all forms <sup>e</sup>	32	8	18	30	120
Consumption, apparent <sup>2, 3</sup>	1,200	1,300	900	1,000	1,000
Price, dollars per metric ton:					
Rutile, bulk, minimum 95% TiO <sub>2</sub> , free on board (f.o.b.) Australia <sup>4</sup>	1,025	1,150	1,175	1,450	1,500
Ilmenite and leucoxene, bulk, f.o.b. Australia <sup>5</sup>	407	478	459	595	580
Ilmenite, average unit value of imports <sup>6</sup>	219	186	215	240	290
Slag, 80%–95% TiO <sub>2</sub> , average unit value of imports <sup>6</sup>	738	792	757	774	830
Employment, mine and mill, number	296	310	315	290	330
Net import reliance <sup>7</sup> as a percentage of apparent consumption	91	92	89	90	81

**Recycling:** None.

**Import Sources (2018–21):** South Africa, 39%; Australia, 15%; Madagascar, 14%; Canada, 10%; and other, 22%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–22</b>
	Synthetic rutile	2614.00.3000	Free.
	Ilmenite and ilmenite sand	2614.00.6020	Free.
	Rutile concentrate	2614.00.6040	Free.
	Titanium slag	2620.99.5000	Free.

**Depletion Allowance:** Ilmenite and rutile, 22% (domestic), 14% (foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** Consumption of titanium mineral concentrates is tied to production of TiO<sub>2</sub> pigments that are primarily used in paint, paper, and plastics. Demand for these primary uses is related to changes in the gross domestic product. Domestic apparent consumption of titanium mineral concentrates in 2022 was estimated to have been unchanged from that in 2021. Inventory changes were not included in the apparent consumption calculation. Exports of titanium mineral concentrates increased significantly owing to increased recovery from mine tailings.

In 2022, as of September, South Africa (37%), Madagascar (16%), Mozambique (15%), and Australia (9%) were the leading sources of titanium mineral concentrates imports to the United States. Mining and heavy-mineral-sand-processing operations were expanded near Starke, FL, and preliminary technical and economic study studies were completed at a heavy-mineral-sands project near Camden, TN. The project plans also included production of synthetic rutile from ilmenite using a proprietary process.

In 2022, China continued to be the leading producer and consumer of titanium mineral concentrates, accounting for more than one-third of global production of ilmenite. Mozambique and South Africa also were leading producers of titanium mineral concentrates. China's imports of titanium mineral concentrates were about 3.4 million tons in gross weight, a decrease of 10% compared with those in 2021. As of October, Mozambique (47%), Kenya (9%), and Vietnam (8%) were the leading sources of titanium mineral concentrates to China. In Saudi Arabia, commissioning of a project to produce up to 500,000 tons per year of titanium slag resumed in 2022 after being delayed in 2021. Exploration projects for heavy-mineral sands were being developed in Australia, Brazil, Canada, China, Finland, Greenland, Kenya, Malawi, Mozambique, Norway, Papua New Guinea, Russia, Senegal, and Tanzania.

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**World Mine Production and Reserves:** Reserves for China, Madagascar, and “Other countries” were revised based on company and Government reports.

	Mine production		Reserves <sup>8</sup>
	<u>2021</u>	<u>2022<sup>e</sup></u>	
<b>Ilmenite:</b>			
United States <sup>2, 9</sup>	100	200	2,000
Australia	600	660	<sup>10</sup> 160,000
Brazil	33	32	43,000
Canada <sup>11</sup>	430	470	31,000
China	3,400	3,400	190,000
India	204	200	85,000
Kenya	181	180	390
Madagascar <sup>11</sup>	414	300	22,000
Mozambique	1,100	1,200	26,000
Norway	468	430	37,000
Senegal	482	520	NA
South Africa <sup>11</sup>	900	900	30,000
Ukraine	316	200	5,900
Vietnam	122	160	1,600
Other countries	<u>137</u>	<u>77</u>	<u>14,000</u>
World total (ilmenite, rounded) <sup>9</sup>	8,900	8,900	650,000
<b>Rutile:</b>			
United States	( <sup>9</sup> )	( <sup>9</sup> )	( <sup>9</sup> )
Australia	190	190	<sup>10</sup> 31,000
India	12	11	7,400
Kenya	72	73	170
Madagascar	—	—	520
Mozambique	8	8	890
Senegal	9	9	NA
Sierra Leone	123	130	490
South Africa	95	95	6,500
Tanzania	—	—	20
Ukraine	95	57	2,500
Other countries	<u>14</u>	<u>14</u>	<u>NA</u>
World total (rutile, rounded) <sup>9</sup>	<u>618</u>	<u>590</u>	<u>49,000</u>
World total (ilmenite and rutile, rounded)	9,500	9,500	700,000

**World Resources:**<sup>8</sup> Ilmenite accounts for about 90% of the world’s consumption of titanium minerals. World resources of anatase, ilmenite, and rutile total more than 2 billion tons.

**Substitutes:** Ilmenite, leucoxene, rutile, slag, and synthetic rutile compete as feedstock sources for producing TiO<sub>2</sub> pigment, titanium metal, and welding-rod coatings.

<sup>e</sup>Estimated. NA Not available. — Zero.

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

<sup>2</sup>Rounded to the nearest 100,000 tons to avoid disclosing company proprietary data.

<sup>3</sup>Defined as production + imports – exports.

<sup>4</sup>Source: Fast Markets IM; average of yearend price.

<sup>5</sup>Source: Zen Innovations AG, Global Trade Tracker.

<sup>6</sup>Landed duty-paid unit value based on U.S. imports for consumption. Source: U.S. Census Bureau.

<sup>7</sup>Defined as imports – exports.

<sup>8</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>9</sup>U.S. rutile production and reserves data are included with ilmenite.

<sup>10</sup>For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves for ilmenite and rutile were estimated to be 37 million and 9.2 million tons, respectively.

<sup>11</sup>Mine production of titaniferous magnetite is primarily used to produce titaniferous slag.