TITANIUM

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In 2004, an expanding world economy and industrial growth in China led to strong demand for titanium mineral concentrates, titanium metal, and titanium dioxide (TiO_2) pigment.

Gross production of titanium mineral concentrates decreased slightly compared with that of 2003. However, on the basis of TiO_2 content, global production of titanium mineral concentrates was estimated to have increased slightly compared with that of 2003. The industry continued the development of new heavy mineral mine capacity. In the United States, one of the two producers of titanium mineral concentrates was expanding mine capacity. Meanwhile, the sole synthetic rutile plant in the United States was idled.

Global consumption of TiO_2 pigment was estimated to be 4.6 million metric tons (Mt), an 8% increase compared with consumption in 2003 (Mineral Sands Report, 2005b). According to U.S. Geological Survey (USGS) survey data, domestic consumption of TiO_2 pigment increased by 9% compared with that of 2003.

Increased demand for titanium used in titanium metal and steel production exceeded the available supply of scrap and production capacity for new metal. Domestic shipments of titanium mill products increased by 22%, while consumption of titanium in steel and other alloys increased by 16% compared with those of 2003. Prices for titanium metal products rose considerably in 2004.

Legislation and Government Programs

The Defense National Stockpile Center (DNSC) continued the sale of titanium sponge held in the National Defense Stockpile (NDS). In fiscal year (FY) 2004, sales from the NDS reduced the inventory of sponge to 2,510 metric tons (t) from 6,420 t in 2003. During 2004, sales were made to Advanced Alloys, Inc.; Global Titanium, Inc.; Goldman Titanium, Inc.; Grandis Metals International Corp.; Ispat Inland, Inc.; Monico Alloys, Inc.; Reading Alloys, Inc.; Specialty Metallurgical Products Co.; Titanium Metals Corp. (Timet); United Alloys, Inc.; and Wogen Titanium Ltd. (Defense National Stockpile Center, 2004a, b).

The U.S. Department of the Army funded ADMA Products, Inc. to develop technology to produce low-cost titanium plate from titanium powder (ADMA Products, Inc., 2005§[1]). The U.S. Department of Defense also funded the Titanium Extraction Mining and Process Engineering Research (TEMPER) Project to identify and develop new extraction and mining technologies to reduce the cost of titanium (Defense Technical Information Center, 2004§).

The Defense Advanced Research Projects Agency's (DARPA) titanium initiative was funding the development of new methods for producing and processing titanium metal and its alloys. In 2003, the DARPA selected Timet to lead a group of contractors in the development of the Fray-Farthing-Chen (FFC) electrolytic process. In 2004, Timet continued work to commercialize the FFC process (Titanium Metals Corp., 2005§). Altair Nanotechnologies Inc. entered into a contract with Timet to provide titanium oxide feedstock for the FFC research funded by the DARPA. Altair developed a titanium oxide electrode structure and supplied Timet with more than 100 pounds [45.4 kilograms (kg)] of titanium oxide feedstock to produce titanium metal in batch production demonstrations (Altair Nanotechnologies Inc., 2004§).

Because of the importance of titanium in defense applications, the DARPA broadened its efforts to involve additional participants. International Titanium Powder L.L.C. (ITP) received a contract to modify its Armstrong plasma reduction process to produce titanium metal powder (International Titanium Powder L.L.C., 2004§). MER Corp. was awarded a contract for development of its electrolytic method to produce titanium metal, and SRI International had been funded to develop a fluidized bed vapor deposition method to produce titanium (U.S. Department of Energy, 2004§).

EHK Technologies published a study performed for the U.S. Department of Energy and the Oak Ridge National Laboratory that summarized the emerging titanium cost reduction technologies. The study identified 16 projects under development to produce titanium metal from titanium bearing oxides (U.S. Department of Energy, 2004§).

The U.S. Department of Homeland Security, U.S. Customs and Border Protection reclassified imports of titanium billet from the unwrought category to the wrought category. This change was made effective for merchandise entered into or withdrawn from the warehouse for consumption on or after February 1, 2004. Although the normal tariff rates for wrought and unwrought titanium were identical (15% ad valorem), wrought products from Russia were subject to the Generalized System of Preferences (GSP) program and entered the United States duty-free (U.S. Department of Homeland Security, U.S. Customs and Border Protection, 2003). However, at yearend, wrought products from Russia lost their duty-free eligibility under the GSP (U.S. International Trade Commission, 2005§).

In January, the U.S. Department of Commerce discontinued its monthly publication of TiO_2 pigment production and stocks. No justification was given for the elimination of the report.

Production

Mineral Concentrates.—Titanium mineral concentrates of economic importance include ilmenite, leucoxene, rutile, titaniferous slag, and synthetic rutile. Mining of titanium

[1]References that include a section mark (§) are found in the Internet References Cited section.

minerals is usually performed using surface methods. Dredging and dry mining techniques are used for the recovery of heavy minerals. Gravity spirals are used to separate the heavy minerals suite, while magnetic and high-tension separation circuits are used to separate the heavy-mineral constituents. Ilmenite is often processed to produce a synthetic rutile or titaniferous slag. Although numerous technologies are used to produce synthetic rutile, nearly all are based on either selective leaching or thermal reduction of iron and other impurities in ilmenite. Titaniferous slag with a TiO_2 content of 75% to 95% is produced commercially using pyrometallurgical processes.

U.S. mineral concentrate producers were DuPont Titanium Technologies (DuPont) (a subsidiary of E.I. du Pont de Nemours & Co. Inc.) and Iluka Resources, Inc. (a subsidiary of Iluka Resources Ltd.). DuPont's mining operations near Starke, FL, produced a mixed product containing ilmenite, leucoxene, and rutile that was used as a captive feedstock in DuPont's TiO_2 pigment plants. Iluka produced titanium mineral concentrates from its heavy-mineral sand operations at Green Cove Springs, FL, and Stony Creek, VA, and from a new mining operation in Lulaton, GA. By yearend, Iluka had completed an expansion of its dry mining capabilities and closed its dredge and floating wet concentrator in Florida. The closure marked the end of 30 years of dredge mining at Green Cove Springs. Iluka's Lulaton operations included only mining and wet concentration. Heavy-mineral concentrate from the Lulaton mine was trucked to the dry separation plant at Green Cove Springs. Iluka's Stony Creek mining operation produced ilmenite concentrate using dry mining techniques. Compared with 2003, Iluka's domestic production of ilmenite increased by 23%, while domestic production of rutile decreased by 11% (Iluka Resources Ltd., 2004§).

Metal.—Commercial production of titanium metal involves the chlorination of titanium-containing mineral concentrates to produce titanium tetrachloride ($TiCl_4$), which is reduced with magnesium (Kroll process) or sodium (Hunter process) to form a commercially pure form of titanium metal. As the metal is formed, it has a porous appearance and is referred to as sponge. Titanium ingot is produced by melting titanium sponge or scrap or a combination of both, usually with various other alloying elements, such as aluminum and vanadium. Electron beam, plasma, scull, and vacuum-arc melting are the commercial methods used to produce ingot. Titanium mill products are produced from the drawing, forging, and rolling of titanium ingot or slab into products of various sizes and shapes. These mill products include billet, pipe and tube, plate, rod and bar, sheet, strip, and wire. Titanium castings are produced by investment casting and rammed graphite mold casting. Ferrotitanium is usually produced by induction melting of titanium scrap with iron or steel. The two standard grades of ferrotitanium that are normally produced contain 40% and 70% titanium.

U.S. producers of titanium sponge in 2004 were The Alta Group and Timet. Alta's 340-metric-ton-per-year (t/yr) plant produced titanium sponge by the Hunter process and supported the company's production of electronic-grade titanium. Timet's 8,600-t/yr plant produced titanium sponge by the traditional Kroll process combined with vacuum distillation (table 2). Data on domestic production of titanium sponge are withheld in order to avoid disclosing company proprietary data. About 20% of the 85,300 t/yr of domestic ingot capacity was based on cold hearth technology; the remainder used vacuum-arc-remelting. As demand for titanium metal products began to rise, U.S. production of ingot rose to 41,400 t in 2004, a 17% increase compared with that of 2003. Production of mill products increased by 23% compared with that of 2003 (table 3). U.S. producers of ferrotitanium were Galt Alloys Inc. and Global Titanium Inc. Data on production of ferrotitanium were not available.

TiO_2 Pigment.—TiO_2 pigment is produced from titanium mineral concentrates by either the chloride route or the sulfate route. In the sulfate process, ilmenite or titanium slag is reacted with sulfuric acid. Titanium hydroxide is then precipitated by hydrolysis, filtered, and calcined. In the chloride process, rutile is converted to $TiCl_4$ by chlorination in the presence of petroleum coke. $TiCl_4$ is oxidized with air or oxygen at about 1,000° C, and the resulting TiO_2 is calcined to remove residual chlorine and any hydrochloric acid that may have formed in the reaction. Aluminum chloride is added to the $TiCl_4$ to assure that virtually all the titanium is oxidized into the rutile crystal structure. Although either process may be used to produce pigment, the decision to use one process instead of the other is based on numerous factors, including raw material availability, freight, and waste disposal costs. In finishing operations, the crude form of the pigment is milled to produce a controlled distribution of particle size and surface treated or coated to improve its functional behavior in different media. Some typical surface treatments include alumina, organic compounds, and silica.

TiO_2 pigment produced by either process is categorized by crystal form as either anatase or rutile. Rutile pigment is less reactive with the binders in paint when exposed to sunlight than is the anatase pigment and is preferred for use in outdoor paints. Anatase pigment has a bluer tone than rutile, is somewhat softer, and is used mainly in indoor paints and in paper manufacturing. Depending on the manner in which it is produced and subsequently finished, TiO_2 pigment can exhibit a range of functional properties, including dispersion, durability, opacity, and tinting.

U.S. production of TiO_2 pigment in 2004 was 1.54 Mt, 8% higher than that in 2003 (table 5). U.S. producers of TiO_2 pigment were DuPont, Kerr-McGee Corp., Louisiana Pigment Co. LP (an NL Industries Inc. and Huntsman Corp. joint venture), and Millennium Inorganic Chemicals Inc. (table 4). TOR Minerals International, Inc. produced a TiO_2 pigment from finely ground synthetic rutile.

In 2004, TOR Minerals added 10,000 t/yr of finely ground TiO_2 pigment capacity at its Corpus Christi, TX, facility, bringing its total capacity to 26,400 t/yr. The expansion used a new production method that lowered processing costs and facilitated the manufacture of a finer pigment with a mean particle size of 0.3 micron (TOR Minerals International, Inc., 2005§).

Kerr-McGee closed its 54,000-t/yr sulfate-route TiO_2 pigment plant at its Savannah, GA, facility. The plant was the last sulfate-route TiO_2 pigment operating in the United States. Poor demand for anatase-grade TiO_2 pigment by the paper industry as well as environmental issues contributed to the decision to idle the plant. Kerr-McGee continued to produce TiO_2 pigment at its chloride-route plants at Savannah and at Hamilton, MS (Industrial Minerals, 2004d).

Consumption

Mineral Concentrates.—On a gross weight basis, 98% of the domestic consumption of titanium mineral concentrates was used to produce TiO_2 pigment. The remaining 2% was used to produce miscellaneous other products including titanium metal, welding rod coatings and fluxes. Based on TiO_2 content, domestic consumption of titanium minerals concentrates was 1.50 Mt, a 6% increase compared with that of 2003 (table 6). Consumption data for titanium concentrates were developed by the USGS from a voluntary survey of domestic operations. Of the 20 operations canvassed, 10 responded, representing 66% of the consumption data in table 6. Data for nonrespondents were estimated based on prior-year consumption with some adjustments for present-year trends.

Metal.—Titanium metal alloys are used for their high strength-to-weight ratio and corrosion resistance. Driven by demand from the aerospace industry, consumption of titanium sponge and scrap by the domestic titanium industry increased by 26% compared with that of 2003 (table 3). Scrap supplied a calculated 46% of ingot feedstock. Estimated U.S. mill product usage by application was as follows: aerospace, 65%, and nonaerospace uses, 35%. Nonaerospace uses included those in the consumer goods, marine, medical, oil and gas, pulp and paper, and specialty chemical industries.

A significant quantity of titanium in the form of sponge, scrap, and ferrotitanium is consumed in the steel and nonferrous alloy industries. Consumption by the steel industry is largely associated with the production of stainless steels and is used for deoxidation, grain-size control, or carbon and nitrogen control and stabilization typically in interstitial-free, stainless, and high-strength low-alloy steels. Reported domestic consumption of titanium products in steel and other alloys was 10,200 t, a 16% increase compared with that of 2003 (table 7). According to one industry report, global demand for titanium was 33,000 t in 2004 (Roskill's Letter from Japan, 2005).

TiO_2 Pigment.—In the United States, apparent consumption of TiO_2 pigment was 1.17 Mt, a 9% increase compared with that of 2003 (table 5). The leading uses of TiO_2 pigment, based on TiO_2 pigment shipments in the United States, were paint and coatings (54%), plastics and rubber (27%), and paper (16%) (table 8). Other uses (8%) included catalysts, ceramics, coated fabrics and textiles, floor coverings, printing ink, and roofing granules.

In the paint and coatings industry, TiO_2 pigment is used in architectural, equipment, and special-purpose applications and is widely used in white and color formulations. The TiO_2 content for paint and coatings varies significantly.

In plastics, TiO_2 pigment provides opacity and acts as a barrier against ultraviolet light degradation. TiO_2 pigment often is introduced as pellets containing up to 50% by weight TiO_2 in a carrier resin; however, liquid and dry concentrates also are used by the industry. The TiO_2 content for plastics normally ranges from 3% to 25% by weight of the finished product. Examples of plastic applications that use TiO_2 pigment include polyethylene bags and vinyl window frames.

TiO_2 pigment in paper products provides opacity and brightness. The paper industry consumes TiO_2 pigment as filler and in coatings. Paper products contain a high percentage of non-TiO_2-base minerals as filler material with the typical TiO_2 content less than 5% of the dry weight of paper. Anatase-grade pigment is preferred in the paper industry because it is less abrasive to papermaking machinery.

Stocks

On a TiO_2 content basis, yearend consumer inventories of titanium mineral concentrates were 369,000 t, a 35% increase compared with those of 2003 (table 9). While consumer stocks of natural rutile and synthetic rutile decreased by 5%, stocks of ilmenite and slag increased by 50% compared with those of 2003. TiO_2 producer stocks of TiO_2 pigment were not available.

Owing to sales from the DNSC inventory, Government stocks of sponge fell to 2,510 t, a 60% decrease compared with those of 2003. Industry stocks of sponge decreased by 6%. While stocks of scrap increased 63% to 7,030 t, stocks of ingot decreased by 20% compared with those of 2003 (table 3).

Prices

The yearend published price range for bulk rutile mineral concentrates was US$430 to US$480 per metric ton, a moderate increase compared with that of 2003. In contrast, the yearend price range for bagged rutile concentrates used in the welding rod coatings industry was US$550 to US$650 per ton, a significant increase compared with that of 2003. Yearend prices of ilmenite concentrates ranged from US$72 to US$90 per ton (table 10). Published prices for titanium slag were not available. Based on U.S. Customs Service data, yearend unit value of slag imports ranged from US$347 to US$466 per ton in 2004, a moderate increase compared with that of 2003.

As capacity utilization rates for TiO_2 pigment plants rose, yearend published prices for anatase- and rutile-grade pigment increased moderately compared with those of 2003. The U.S. Department of Labor, Bureau of Labor Statistics producer price index for TiO_2 pigment increased to 148.9 in December 2004 from 146.1 in December 2003 (U.S. Department of Labor, Bureau of Labor Statistics, 2005§).

Because of a significant increase in demand, prices of titanium metal products rose considerably. The yearend unit value of titanium sponge ranged from US$3.55 to US$6.44 per pound in 2004, a significant increase compared with that of 2003. The yearend price range for titanium scrap also reflected market conditions, increasing to between US$3.80 and US$4.00 per pound in 2004 from between US$1.50 and US$1.70 per pound in 2003. The published price increase was substantiated by a 71% increase in the unit value of waste and scrap imports. Increased demand for ferrotitanium by steel producers was reflected in a significant increase in ferrotitanium prices. The published price range for ferrotitanium with 70% contained titanium doubled compared with that of 2003.

Foreign Trade

Mineral Concentrates.—The United States is heavily reliant on imports of titanium mineral concentrates because domestic demand for titanium minerals greatly exceeds domestic production. Exports of titanium concentrates are minor. In 2004, exports of titanium mineral concentrate were 8,690 t, a 16% decrease compared with 2003 (table 11).

Imports of titanium mineral concentrates include ilmenite, rutile, synthetic rutile, and titaniferous slag. In 2004, although the gross tonnage decreased, the combined value for all forms of titanium concentrate imports increased 9% compared with that of 2003 to US$397 million. This increase was owing to higher prices for some products and increased reliance on high-grade mineral concentrates.

In 2004, imports of ilmenite were 244,000 t, a 38% decrease compared with those of 2003. The leading import sources of ilmenite were Australia (49%), Ukraine (29%), and Vietnam and South Africa (11% each). Based on the unit value, 26,700 t of ilmenite imports from South Africa appear to be misclassified titaniferous slag or rutile. Cessation of imports of ilmenite from Malaysia were offset by increased imports from Vietnam. The closure of sulfate-route TiO_2 pigment capacity contributed to the overall decrease in imported ilmenite.

Imports of titaniferous slag were 457,000 t, a 12% increase compared with those of 2003. South Africa (73%) and Canada (27%) were the only import sources of titanium slag.

Imports of natural and synthetic rutile totaled 360,000 t. Australia (54%) and South Africa (41%) were the major import sources of natural and synthetic rutile in 2004. Although imports of natural and synthetic rutile from South Africa increased, decreased imports from Australia resulted in a significant drop in natural and synthetic rutile imports compared with those of 2003.

Imports of titaniferous iron ore from Canada, classified as ilmenite by the U.S. Census Bureau, increased by 263% compared with those in 2003. Titaniferous iron ore was used by the steel industry to protect the crucibles of blast furnaces. In this report, imports of titaniferous iron ore from Canada are separated from ilmenite statistics (table 12).

Metal.—Prompted by a tariff classification ruling by U.S. Customs Service, the 2004 Harmonized Tariff Schedule of the United States (HTS) codes used to classify imports of titanium metal were changed. In the 2004 HTS, the unwrought codes for "Billet" and "Bloom, sheet bars, and slab" were eliminated. In addition, the HTS code for "Other, unwrought" was changed to 8108.20.0091 from 8108.20.0090.

Imports of titanium metal are primarily in the form of unwrought titanium. Kazakhstan (48%), Japan (39%), and Russia (12%) were the major sources of imported titanium sponge, while Japan (27%), Germany (18%), the United Kingdom (14%), and France (11%) were the leading sources of imported waste and scrap. Owing to increased imports from Germany and Russia, imports of ingot increased by 131%. Imports of titanium powder were 142 t, a 10% increase compared with those of 2003. China (75%), Japan (12%), and Belgium (9%) were the major sources of titanium powder. Imports of other unwrought forms of titanium (excluding billet, bloom, sheet bar, and slab) increased by 43%.

Imports of titanium wrought products and castings are primarily in the form of bar, rod, profiles, and wire (54%) and plate, sheet, strip and foil (22%). Russia (69%) and Japan (13%) were the major import sources of wrought products and castings. While imports of wrought products and castings were nearly unchanged, exports of wrought products and castings increased by 28%.

Imports of ferrotitanium and ferrosilicon titanium, primarily used in the iron and steel industry, were 6,940 t, a 120% increase compared with those of 2003. Exports of ferrotitanium and ferrosilicon titanium were 2,790 t, a 188% increase compared with those of 2003.

TiO_2 Pigment.—The United States continued to be a net exporter of TiO_2 pigment. In 2004, exports exceeded imports by a ratio of 2.4 to 1. Exports of TiO_2 pigment were 635,000 t, a 9% increase compared with that of 2003. About 91% of exports were in the form of finished pigment with more than 80% TiO_2 content.

During 2004, 264,000 t of TiO_2 pigment was imported, a 10% increase compared with the previous year (table 14). The leading import sources of TiO_2 pigment were Canada (28%), Germany (9%), China (8%), and France (8%). Compared with those of 2003, imports of TiO_2 pigment containing more than 80% TiO_2 were nearly unchanged at 199,000 t, other TiO_2 pigment increased by 5% to 5,370 t, and unfinished TiO_2 (unmixed and not surface treated) increased by 58% to 59,300 t.

World Review

Australia.—Auspac Resources NL and Southern Titanium NL signed an agreement to investigate the development of the WIM 150 heavy mineral deposit near Horsham, Victoria. Although Austpac had tested the processing of ilmenite from WIM 150, a larger scale pilot plant work study was expected to lead to a viable plant design. The WIM deposit was estimated to contain 12.5 Mt of relatively finer grain ilmenite (Industrial Minerals, 2004a).

Bemax Resources NL began construction of the Pooncarie mineral sands project. The project consist of three main operations—the Ginkgo mine site, located near Pooncarie in the Murray Basin, New South Wales; the Broken Hill separation plant, New South Wales; and the Bunbury, Western Australia, separation plant. Production from the Pooncarie project was expected to reach 573,000 t of heavy minerals by 2006. Bemax completed a merger with Sons of Gwalia Ltd. and RZM Cable Sands Pty. Ltd. (Industrial Minerals, 2004b). Because of the merger and potential development of Pooncarie, Murray Basin Titanium Pty Ltd.'s (jointly owned by RZM Cable Sands and Sons of Gwalia) Wemen, Victoria, mine was closed (Industrial Minerals, 2004f). In Western Australia, Bemax commissioned the Ludlow mine and wet separation plant. At yearend, Bemax proven reserves in the Murray Basin and Western Australia contained 6,034 Mt of heavy minerals (Bemax Resources NL, 2005§).

Consolidated Rutile Ltd. (CRL) started dredge mining operations at its Enterprise deposit on North Stradbroke Island, Queensland. At yearend, CRL's reserves for the Enterprise and nearby Yarraman deposits included 6.7 Mt of heavy minerals (Consolidated Rutile Ltd., 2005§).

In the Murray Basin in southwestern Victoria, Iluka planned to invest A$270 in the Douglas mineral sands project. The investment included construction of the Douglas mine and wet concentrating facilities near Balmoral, a dry mineral separation plant near Hamilton, and improvements in regional infrastructure. The Douglas project was expected to be the first of two or three rutile and zircon projects developed by Iluka in the Murray Basin before the end of this decade. Iluka has identified two additional potential Murray Basin projects. By the end of 2004, the Douglas project was approximately one-third complete. Details on the capacity of the new operations were not available (Iluka Resources Ltd., 2004§).

In Western Australia, near Perth, Iluka planned to begin mining operations at its Gingin and Wagerup mineral sands deposits by the second quarter of 2005. Wet concentrate from the mines was to be processed at the Capel and Narngulu dry separation plants. Wagerup was expected to produce 750,000 t of ilmenite for sulfate-route TiO_2 pigment production during a 2.5-year period, while Gingin was expected to produce 600,000 t of ilmenite for use as synthetic rutile feedstock, 310,000 t of chloride-grade ilmenite, and 75,000 t of rutile, during a 3.5-year period (Iluka Resources Ltd., 2004§).

In the Eucla Basin in southern Australia, Iluka discovered the Jacinth and Ambrosia mineral sands deposits. The Jacinth deposit was estimated to contain an inferred mineral resource of 108 Mt of ore with an average 6% heavy minerals. The heavy mineral assemblage consists of 22% ilmenite, 7% rutile, and 55% zircon. Iluka planned to conduct additional exploration drilling in the area during 2005 (Iluka Resources Ltd., 2004§).

Gunson Resources Ltd. announced positive results of a bankable feasibility study on its Coburn mineral sands project in Western Australia. The company planned to begin mine construction once environmental approvals, offtake agreements, and funding arrangements were completed (Gunson Resources Ltd., 2004§).

Matilda Minerals Ltd. was proceeding with the exploration and development in the Tiwi Islands. At its Lethbridge Bay West deposit, drilling analysis confirmed the existence of near surface mineral sands with up to 37% heavy minerals. The company planned to complete a feasibility study in 2005 (Matilda Minerals Ltd., 2005§).

Monto Minerals Ltd. was proceeding with the development of its feldspar-ilmenite-apatite Goondicum project in Queensland. At midyear, the company had completed the design and construction of a trail processing plant and a feldspar washing facility. More than 1,500 t of apatite, feldspar, and ilmenite were produced for commercial-scale testing (Monto Minerals Ltd., 2005§).

Canada.—Titanium Corp., Inc. continued efforts to commercialize the recovery of titanium minerals from the oil sands tailings of Syncrude Canada Ltd. in Alberta. In 2004, Titanium Corp. commissioned a pilot-plant facility in Regina, Saskatchewan, and recovered wet and dry heavy mineral concentrates for commercial testing (Titanium Corporation, Inc., 2004§).

QIT Fer et Titane Inc. planned to invest US$76 million to expand capacity at its UGS titaniferous slag plant at Sorel, Quebec, to 325,000 t/yr from 250,000 t/yr by early 2005. The UGS plant converts QIT's sulfate-grade slag containing about 80% TiO_2 into a chloride-grade slag containing about 95% TiO_2. The UGS plant has the potential to be expanded to 600,000 t/yr (Rio Tinto plc, 2004§).

China.—In 2004, China's tremendous industrial demand continued to influence the global titanium industry. China's production of titanium mineral concentrates increased by 5% compared with 2003. According to one industry report, China's production of ilmenite in 2004 was 840,000 t, while demand was more than 1.3 Mt (Mineral Sands Report, 2005a).

According to the Chinese Titanium Association, China's consumption of titanium sponge increased to 6,590 t in 2004, and production increased to 4,810 t. The growth was attributed to increased demand for titanium in consumer electronics, chemical processing equipment, and military applications (Roskill's Letter from Japan, 2005).

Chinese TiO_2 pigment production is primarily based on a large number of sulfate-route plants, each with capacity of 20,000 t/yr or less. Following significant growth in 2003, China's production of TiO_2 pigment increased to more than 440 Mt (Mineral Sands Report, 2005b).

Xingmao Titanium Industry Co. Ltd. planned to construct a 60,000-t/yr chloride-route TiO_2 pigment plant. Xingmao expected to add the new capacity to its existing 30,000-t/yr sulfate-route TiO_2 plant by yearend 2006 (TZ Minerals International Pty. Ltd., 2004§).

Plans were underway to increase China's titanium sponge production to 10,000 t/yr by 2010. The Fushun Aluminium facility in Liaoning Province planned to increase sponge production capacity to 5,000 t/yr from 1,500 t/yr. In 2004, Zunyi Titanium Co. Ltd. started a new 5,000-t/yr sponge plant (Faizulla, 2004).

France.—Millennium Inorganic Chemicals reduced its sulfate-route TiO_2 pigment capacity at its Le Havre facility by 30,000 t/yr. Yearend capacity at Le Havre was 65,000 t/yr (Millennium Chemicals Inc., 2004§).

Japan.—According to the Japan Titanium Society, Japan's production of titanium sponge in 2004 was 23,110 t, a 22% increase compared with production in 2003 (Roskill's Letter from Japan, 2005). Japanese titanium sponge producer Toho Titanium Co. planned to increase capacity to 15,000 t/yr from 13,000 t/yr by yearend 2005. The expansion was scheduled to be implemented in two 1,000-t/yr increments introduced in February and October 2005 (Reuters, 2004§).

Kazakhstan.—Production of titanium sponge from the Ust Kamenogorsk Titanium and Magnesium Combine (UTMK) was estimated to be 16,500 t, a 32% increase compared with production in 2003. Virtually all UTMK sponge production was exported.

Kenya.—Tiomin Resources Inc. continued the development of its Kwale heavy-mineral deposit. In 2004, Tiomin was conducting an engineering review and began a drilling program to define the water resource in the project area. In July, Tiomin received a renewable mining lease for the Kwale deposit. Mine construction was scheduled to begin late in 2005. Production may begin in 2007. When commissioned, the mine is expected produce 330,000 t/yr of ilmenite and 77,000 t/yr of rutile during the first 6 years of operation (Tiomin Resources Inc., 2005§).

Madagascar.—Rio Tinto plc continued feasibility studies for the development of its QIT Madagascar Minerals (QMM) mineral sands project near Fort-Dauphin. If developed, the project was expected to provide ilmenite feed to the QIT slag facility in Canada. The project includes construction of a dredging operation, a port in Madagascar, and upgrading of the Sorel-Tracy slag facility in Canada. The mining operation was scheduled to be completed in 2008 with 750,000 t/yr of ilmenite capacity (Rio Tinto plc., 2005§).

Mozambique.—Kenmare Resources plc began construction at its Moma mineral sands project. Initial production was expected in 2006. When fully operational, the Moma operation is expected to produce 700,000 t/yr of ilmenite and 17,000 t/yr of rutile. Reserves were estimated to include 16.4 Mt ilmenite and 0.5 Mt of rutile; exploration activity in the surrounding area was ongoing (Kenmare Resources plc., 2005§).

Poland.—Zaklady Chemiczne "Police" SA made plans to increase its sulfate-route TiO_2 pigment capacity to 65,000 t/yr from 42,000 t/yr. In addition, the Polish Government consented to a plan to privatize the company in 2005. In 2004, Police produced 41,010 t of TiO_2 pigment (Zaklady Chemiczne "Police" SA, 2005§).

Russia.—Sponge production at the AVISMA Titanium-Magnesium Combine was estimated to be 26,000 t in 2004. Shareholders of AVISMA and Verkhnyaya Salda Steel-Making Industrial Association (VSMPO) voted to merge the two companies (Metal-Pages Ltd., 2004§). AVISMA's plant in Berezniki has been the primary source of sponge to VSMPO's ingot and mill product production facility in Verkhnaya Salda.

Sierra Leone.—Sierra Rutile Ltd. (SRL) planned to restart its mining operation in Moyamba by yearend 2005. The operation has been idle since 1995 when a civil war forced its closure. Initial capacity is expected to be 110,000 t/yr of rutile and 8,000 t/yr of ilmenite. Plans for a second dredge would raise production capacity to 210,000 t/yr of rutile and 45,000 t/yr of ilmenite by 2009. Reserves in Sierra Leone were expected to support the operation until 2024 (Industrial Minerals, 2004c).

South Africa.—In September, Ticor South Africa idled one of its two slag furnaces near Richards Bay. During the shutdown, which lasted through December, the company performed maintenance and design improvements to the furnace and stockpiled excess ilmenite production from its Hillendale mine and Empangeni separation facility (Ticor Ltd., 2005§).

In July, Huntsman reduced sulfate-route TiO_2 pigment capacity at its Umbogintwini facility by 15,000 t/yr. The Umbogintwini plant is the sole producer of TiO_2 pigment in South Africa. Yearend capacity at the Umbogintwini facility was 25,000 t/yr (Huntsman Corp., 2005§).

Ukraine.—The Ukrainian Government and RSJ Erste Beteiligungsgesellschaft mbH agreed to form a joint venture called Titan Crimea Ltd. The agreement was expected to increase capacity at the Armayansk sulfate-route TiO_2 pigment plant to 88,000 t/yr by 2006 from 75,000 t/yr in 2004. In the future, the state-owned Volnogorsk and Irshansk mining operations were expected to be brought under Titan Crimea (Industrial Minerals, 2004e).

Zaporozhye Titanium-Magnesium Plant produced an estimated 7,500 t of titanium sponge in 2004, an 8% increase compared with that of the previous year. The ZTMK plant was constructed in the 1950s with a design capacity of 20,000 t/yr. Although the plant was idle for several years following the breakup of the Soviet Union, production resumed in 1998 and has been gradually increasing.

United Kingdom.—In November, Huntsman reduced sulfate-route TiO_2 pigment capacity at its Grimsby facility by 40,000 t/yr. Cost savings was cited as the reason for the closure. The closure left 40,000 t/yr of capacity active at Grimsby (Huntsman Corp., 2005§).

Outlook

Because the major end uses of TiO_2 pigment are paint, paper, and plastics, consumption is driven by economic activity. Global long-term growth of TiO_2 consumption is expected to be between 2% and 4% per year. Domestic consumption of TiO_2 is tied to gross domestic product. Increased consumption of TiO_2 pigment in Latin America and China is expected to stimulate expansion of TiO_2 production capacity. During the next 2 years, increased global consumption is expected to be met through process improvements of existing plants.

The abundance of mineral development projects currently underway should ensure an adequate supply of titanium mineral concentrates during the next decade. Some existing projects may be delayed to avoid an oversupply of titanium mineral concentrates. Although demand for sulfate-grade feedstock has waned during the past decade, the recent expansion of sulfate-route TiO_2 pigment capacity in China should increase demand for sulfate-grade mineral feedstock.

Historically, the titanium metal consumption has been led by demand from the aerospace industry and has been highly cyclical. Based on orders for commercial aircraft and military programs, during the next 2 years demand for titanium metal may exceed record levels. Numerous government and private industry programs are working to commercialize lower cost methods for producing titanium metal. These efforts are not expected to significantly affect the titanium industry during the next 2 years. However, the long-term effect of these programs may significantly expand the use of titanium metal.

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TABLE 1
SALIENT TITANIUM STATISTICS[1]

		2000	2001	2002	2003	2004
United States:						
Ilmenite and titaniferous slag:						
Imports for consumption	metric tons	918,000	1,060,000	840,000	804,000	701,000
Consumption[2]	do.	1,250,000	1,180,000	1,300,000	1,300,000	1,480,000
Rutile concentrate, natural and synthetic:						
Imports for consumption	do.	438,000	325,000	390,000	427,000	360,000
Consumption	do.	537,000	483,000	487,000	489,000 r	445,000
Sponge metal:						
Imports for consumption	do.	7,240	13,300	10,700	9,590	11,900
Consumption	do.	18,200	26,200	17,300	17,100 r	21,200
Price, yearend[3]	dollars per pound	3.95	3.58	3.64	2.72-3.95	3.55-6.44
Titanium dioxide pigment:						
Production	metric tons	1,400,000	1,330,000	1,410,000	1,420,000	1,540,000
Imports for consumption	do.	218,000	209,000	231,000	240,000	264,000
Consumption, apparent	do.	1,150,000 [4]	1,100,000 [4]	1,110,000 [4]	1,070,000 [4]	1,170,000 [5]
Price, December 31:						
Anatase	dollars per pound	0.92-0.94	0.92-0.94	0.85-0.95	0.85-0.95	0.90-0.95
Rutile	do.	0.99-1.02	1.00-1.09	0.85-0.95	0.85-0.90	0.90-0.95
World, production:						
Ilmenite concentrate[6]	metric tons	4,940,000 r	5,110,000 r	5,420,000 r	5,690,000 r	5,640,000
Rutile concentrate, natural[7]	do.	409,000 r	421,000 r	446,000 r	361,000 r	353,000
Titaniferous slag	do.	2,000,000 r	2,040,000	1,870,000 r	1,880,000 r	1,890,000

[r] Revised.
[1] Data are rounded to no more than three significant digits; except prices.
[2] Excludes consumption used to produce synthetic rutile.
[3] Land duty-paid unit based on U.S. imports for consumption.
[4] Production plus imports minus exports plus stock decrease or minus stock increase.
[5] Production plus imports minus exports plus stock decrease or minus stock increase. Excludes stock changes.
[6] Includes U.S. production of ilmenite, leucoxene, and rutile rounded to one significant digit to avoid disclosing company proprietary data.
[7] U.S. production of rutile included with ilmenite to avoid disclosing company proprietary data.

TABLE 2
U.S. TITANIUM METAL PRODUCTION CAPACITY IN 2004[1, 2]

(Metric tons per year)

		Yearend capacity	
Company	Plant location	Sponge	Ingot[3]
Allvac (Allegheny Technologies Inc.)	Albany, OR	--	10,900
Do.	Monroe, NC	--	11,800
Do.	Richland, WA	--	10,000
Alta Group (Honeywell International Inc.)	Salt Lake City, UT	340	--
Howmet Corp. (Alcoa Inc.)	Whitehall, MI	--	3,200
RMI Titanium Co. (RTI International Metals, Inc.)	Niles, OH	--	16,300
Titanium Metals Corp.	Henderson, NV	8,600	12,300
Do.	Morgantown, PA	--	20,000
Do.	Vallejo, CA	--	800
Total		8,940	85,300

-- Zero.
[1] Data are rounded to no more than three significant digits; may not add to totals shown.
[2] Estimated operating capacity based on 7-day-per-week full production.
[3] Includes electron-beam, plasma, and vacuum-arc-reduction capacity.

TABLE 3
COMPONENTS OF U.S. TITANIUM METAL SUPPLY AND DEMAND[1]

(Metric tons)

Component	2003	2004
Production:		
Ingot	35,500	41,400
Mill products	21,300	26,300
Exports:		
Sponge	4,990	2,410
Waste and scrap	5,320	9,780
Other unwrought[2]	1,730	1,940
Wrought products and castings[3]	6,510	8,300
Total	18,500	22,400
Imports:		
Sponge	9,590	11,900
Waste and scrap	5,550	8,830
Other unwrought	1,580 [2]	2,640
Wrought products and castings[4]	3,640	3,590
Total	20,400	26,900
Stocks, yearend:		
Government, sponge (total inventory)	6,420	2,510
Industry:		
Sponge	8,180	7,660
Scrap	4,320	7,030
Ingot	3,800	3,040
Consumption, reported:		
Sponge	17,100 r	21,200
Scrap	14,300	18,500
Ingot	27,900	34,400
Shipments:		
Ingot (net shipments)	9,780 r	8,300
Mill products (net shipments):		
Forging and extrusion billet	5,380	6,360
Plate, sheet, strip	5,200	7,940
Rod, bar, fastener stock, wire	4,520	4,570
Other[5]	549	196
Total	15,700	19,100
Castings (shipments)	459	W
Receipts, scrap:		
Home	5,600	7,730
Purchased	11,800	16,500

[r]Revised. W Withheld to avoid disclosing company proprietary data.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes billet, bloom, ingot, powder, sheet bar, slab, and other.
[3]Includes ingot, powder, and other. Billet, bloom, sheet bar and slab classified as wrought in 2004.
[4]Includes castings, foil, pipe, profiles, tube, other wrought and articles of titanium not elsewhere specified or included.
[5]Data for pipe, tube, and other have been combined to avoid disclosing company proprietary data.

TABLE 4

CAPACITIES OF U.S. TITANIUM DIOXIDE PIGMENT PLANTS ON DECEMBER 31, 2004[1, 2, 3]

(Metric tons per year)

Company	Plant location	Process	Capacity
E.I. du Pont de Nemours & Co. Inc.	De Lisle, MS	Chloride	300,000
Do.	Edgemoor, DE	do.	154,000
Do.	New Johnsonville, TN	do.	380,000
Kerr-McGee Corp.	Savannah, GA[4]	do.	110,000
Do.	Hamilton, MS	do.	225,000
Louisiana Pigment Co. LP	Lake Charles, LA	do.	140,000
Millennium Inorganic Chemicals Inc.	Ashtabula, OH	do.	220,000
Do.	Baltimore, MD	do.	50,000
Total			1,580,000

[1]Estimated operating capacity based on 7-day-per-week full production.

[2]Table does not include TOR Minerals International's Corpus Christi, TX, production capacity of about 16,400 metric tons per year (t/yr) of buff TiO_2 pigment that is produced by refining and fine grinding of synthetic rutile.

[3]Data are rounded to no more than three significant digits; may not add to totals shown.

[4]Kerr-McGee Corp.'s 54,000-t/yr sulfate plant was idled in September 2004.

TABLE 5

COMPONENTS OF U.S. TITANIUM DIOXIDE PIGMENT SUPPLY AND DEMAND[1]

		2003		2004	
		Gross weight	TiO_2 content	Gross weight	TiO_2 content
Production[2]	metric tons	1,420,000	1,340,000 e	1,540,000	1,440,000 e
Shipments:[3]					
Quantity	do.	1,430,000	1,350,000	1,700,000	1,600,000 e
Value	thousands	$2,610,000	$2,610,000	$3,190,000	$3,190,000 e
Exports	metric tons	584,000	549,000 e	635,000	597,000 e
Imports for consumption	do.	240,000	226,000 e	264,000	248,000 e
Stocks, yearend	do.	156,000	146,000 e	NA	NA
Consumption, apparent[4]	do.	1,070,000	1,000,000	1,170,000 e, 5	1,090,000 e, 5

[e]Estimated. NA Not available.

[1]Data are rounded to no more than three significant digits.

[2]Excludes production of buff pigment.

[3]Includes interplant transfers.

[4]Production plus imports minus exports plus stock decrease or minus stock increase.

[5]Excludes stock changes.

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 6

U.S. CONSUMPTION OF TITANIUM CONCENTRATE[1]

(Metric tons)

	2003		2004	
	Gross weight	TiO_2 content	Gross weight	TiO_2 content
Ilmenite and titaniferous slag:[2, 3]				
Pigment	1,280,000	NA	1,460,000	NA
Miscellaneous[4]	16,700	NA	19,300	NA
Total	1,300,000	959,000	1,480,000	1,080,000
Rutile, natural and synthetic:				
Pigment	466,000	NA	418,000	NA
Miscellaneous[4]	22,500	NA	26,700	NA
Total	489,000	453,000	445,000	414,000
Total concentrate:				
Pigment	1,750,000	NA	1,880,000	NA
Miscellaneous[4]	39,200	NA	45,900	NA
Total	1,790,000	1,410,000	1,920,000	1,500,000

NA Not available.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes a mixed product containing rutile, leucoxene, and altered ilmenite.

[3]Excludes ilmenite used to produce synthetic rutile.

[4]Includes alloys, carbide, ceramics, chemicals, glass fibers, titanium metal, and welding-rod coatings and fluxes.

TABLE 7

U.S. CONSUMPTION OF TITANIUM IN STEEL AND OTHER ALLOYS[1, 2]

(Metric tons)

	2003	2004
Steel:		
Carbon steel	2,700	4,180
Stainless and heat-resisting steel	3,050	3,130
Other alloy steel[3]	1,140	1,420
Total steel	6,890	8,740
Superalloys	1,160	628
Alloys, other than above	747	826
Miscellaneous and unspecified	26	12
Grand total	8,820	10,200

[1]Includes ferrotitanium, scrap, sponge, and other titanium additives.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Includes high-strength low-alloy and tool steel.

TABLE 8
U.S. DISTRIBUTION OF TITANIUM PIGMENT SHIPMENTS, TITANIUM DIOXIDE CONTENT, BY INDUSTRY[1]

(Percent)

Industry	2003	2004
Paint, varnish, lacquer	55.8	53.6
Paper	16.1	16.0
Plastics	22.5 [2]	27.2
Other[3]	5.6	3.2
Total	100.0	100.0

[1]Excludes exports.
[2]Includes rubber.
[3]Includes agricultural, building materials, ceramics, coated fabrics and textiles, cosmetics, food, paper, and printing ink. Also includes shipments to distributors.

TABLE 9
U.S. STOCKS OF TITANIUM CONCENTRATES AND PIGMENT, DECEMBER 31[1]

(Metric tons)

	2003		2004	
	Gross weight	TiO_2 content	Gross weight	TiO_2 content
Concentrates:[2]				
Ilmenite and titaniferous slag	244,000	200,000	416,000	299,000
Rutile, natural and synthetic	79,700	73,800	75,400	70,000
Titanium pigment[3]	156,000	146,000 [e]	NA	NA

[e]Estimated. NA Not available.
[1]Data are rounded to no more than three significant digits.
[2]Consumer stocks.
[3]Source: U.S. Census Bureau. Producer stocks only.

TABLE 10
PUBLISHED PRICES OF TITANIUM PRODUCTS

		2003	2004
Concentrate:			
Ilmenite, free on board (f.o.b.) Australian ports[1]	dollars per metric ton	80-100	72-90
Rutile, bagged, f.o.b. Australian ports[1]	do.	430-540	550-650
Rutile, bulk, f.o.b. Australian ports[1]	do.	415-445	430-480
Titaniferous slag, 80% to 95% TiO_2[2]	do.	385-444	347-466
Metal:			
Sponge[2]	dollars per pound	2.72-3.95	3.55-6.44
Scrap, turnings, unproccessed[3]	do.	1.50-1.70	3.80-4.00
Ferrotitanium, 70% Ti[3]	do.	3.00-3.20	6.35-6.45
Pigment:			
TiO_2 pigment, f.o.b. U.S. plants, anatase[4]	do.	0.85-0.95	0.90-0.95
TiO_2 pigment, f.o.b. U.S. plants, rutile[4]	do.	0.85-0.90	0.90-0.95

[1]Source: Industral Minerals.
[2]Landed duty-paid unit value based on U.S. imports for consumption.
[3]Source: Platts Metals Week.
[4]Source: Chemical Market Reporter.

TABLE 11

U.S. EXPORTS OF TITANIUM BY CLASS[1]

Class	HTS[2]	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Metal:					
Waste and scrap	8108.30.0000	5,320	$29,200	9,780	$59,900
Unwrought:					
Sponge	8108.20.0010	4,990	62,500	2,410	16,800
Ingot	8108.20.0030	861	10,900	951	14,400
Billet	8108.20.0045	175	4,250	179	4,800
Bloom, sheet bar, slab	8108.20.0060	318	7,410	375	7,490
Other	8108.20.0090	375	13,600	430	7,090
Wrought product and castings:					
Bar, rod, profile, wire	8108.90.6030	2,550	77,400	3,310	112,000
Other	8108.90.8000	3,960	174,000	4,990	191,000
Total metal		18,500	379,000	22,400	413,000
Ferrotitanium and ferrosilicon titanium	7202.91.0000	967	2,930	2,790	7,690
Ores and concentrates	2614.00.0000	10,300	2,720	8,690	3,370
Pigment:					
80% or more titanium dioxide pigment	3206.11.0000	518,000	855,000	576,000	968,000
Other titanium dioxide pigment	3206.19.0000	43,700	65,500	36,900	81,900
Unfinished titanium dioxide[3]	2823.00.0000	23,000	38,000	22,000	35,700
Total		584,000	958,000	635,000	1,090,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Unmixed and not surface treated.

Source: U.S. Census Bureau.

TABLE 12

U.S. IMPORTS FOR CONSUMPTION OF TITANIUM CONCENTRATE, BY COUNTRY[1]

Concentrate and country	HTS[2]	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Ilmenite:	2614.00.6020				
Australia		238,000	$20,200	120,000	$16,700
Malaysia		10,200	642	--	--
South Africa		18,200	6,620	26,700	11,700
Ukraine		89,100	7,820	70,000	9,770
Vietnam		38,500	2,890	27,000	2,750
Other		1,440	1,270	--	--
Total		395,000	39,500	244,000	40,900
Titaniferous slag:	2620.99.5000				
Canada		57,700	25,700	122,000	56,600
South Africa		351,000	138,000	335,000	135,000
Other[3]		23	10	97	31
Total		409,000	163,000	457,000	192,000
Rutile, natural:	2614.00.6040				
Australia		117,000	43,500	57,100	32,900
South Africa		123,000	51,400	147,000	63,200
Ukraine		15,100	5,720	684	428
Other[3]		173	179	10,900	3,420
Total		255,000	101,000	216,000	99,900
Rutile, synthetic:	2614.00.3000				
Australia		164,000	57,000	138,000	62,300
Malaysia		8,610	4,260	5,440	2,390
Other		10	18	60	60
Total		172,000	61,200	144,000	64,800
Titaniferous iron ore, Canada[4]	2614.00.6040	18,900	1,390	68,700	3,650

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Data being verified by the U.S. Census Bureau.

[4]Includes materials consumed for purposes other than production of titanium commodities, principally heavy aggregate and steel-furnace flux. Titaniferous iron ore from Canada is classified as ilmenite under the HTS.

Source: U.S. Census Bureau. Data adjusted by the U.S. Geological Survey.

TABLE 13

U.S. IMPORTS FOR CONSUMPTION OF TITANIUM METAL, BY CLASS AND COUNTRY[1]

Class and country	HTS[2]	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Waste and scrap:	8108.30.0000				
Canada		307	$831	835	$4,690
France		918	3,560	941	5,190
Germany		671	3,090	1,620	13,300
Israel		91	327	268	1,780
Japan		1,500	4,760	2,340	12,400
Taiwan		328	1,050	641	4,240
United Kingdom		1,040	3,650	1,210	6,480
Other		699 r	2,420 r	972	5,520
Total		5,550	19,700	8,830	53,600

See footnotes at end of table.

TABLE 13—Continued

U.S. IMPORTS FOR CONSUMPTION OF TITANIUM METAL, BY CLASS AND COUNTRY[1]

Class and country	HTS[2]	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Unwrought:					
Sponge:	8108.20.0010				
Japan		4,210	$31,400	4,600	$32,100
Kazakhstan[e]		4,970	30,200	5,670	38,000
Russia		270	1,250	1,380	8,180
Other		140	625	205	1,280
Total		9,590	63,500	11,900	79,500
Ingot	8108.20.0030				
Germany		86	1,270	271	3,320
Russia		529	4,800	1,150	10,300
Other		48 r	641 r	115	1,150
Total		663 r	6,710 r	1,530	14,800
Billet, bloom, sheet bar, slab:[3]	8108.20.0045 and 8108.20.0060				
Japan		24	847	XX	XX
United Kingdom		79	2,830	XX	XX
Other		10	181	XX	XX
Total		113	3,860	XX	XX
Powder:	8108.20.0015				
China		114	739	107	1,130
Other		15	1,150	35	1,710
Total		129	1,890	142	2,840
Other:	8108.20.0090 (2003), 8108.20.0091 (2004)				
France		149	462	271	2,770
Japan		264	1,800	349	2,710
United Kingdom		87	431	181	1,930
Other		169 r	675 r	158	931
Total		669 r	3,370 r	959	8,350
Wrought products and castings:[4]	8108.90.3030, 8108.90.3060, 8108.90.6030, 8108.90.6045, 8108.90.6060, 8108.90.6075				
Canada		106	4,860	76	3,090
China		53	1,430	49	1,990
Italy		156	4,990	92	2,700
Japan		333	9,650	456	14,600
Mexico		108	4,840	55	2,180
Russia		2,600	40,300	2,470	42,900
United Kingdom		107	9,250	160	13,700
Other		172 r	7,320 r	233	10,300
Total		3,640	82,600	3,590	91,500
Ferrotitanium and ferrosilicon titanium	7202.91.0000	3,160	9,670	6,940	21,200

[e]Estimated. [r]Revised. XX Not applicable.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Reclassified as "Wrought products" in 2004.

[4]Includes bar, castings, foil, pipe, plate, profile, rod, sheet, strip, tube, wire, and other.

Source: U.S. Census Bureau.

TABLE 14

U.S. IMPORTS FOR CONSUMPTION OF TITANIUM PIGMENT, BY COUNTRY[1]

Country	HTS[2]	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
80% or more titanium dioxide pigment:	3206.11.0000				
Australia		--	--	3,360	$5,480
Belgium		6,450	$9,440	7,340	10,900
Canada		68,500	112,000	71,800	115,000
China		8,640	10,200	9,190	11,500
Czech Republic		1,540	2,600	1,080	1,710
Finland		4,430	8,080	9,700	17,700
France		4,470	7,140	4,680	6,900
Germany		27,400	45,300	13,200	23,700
Italy		9,510	14,400	10,100	13,600
Japan		9,690	17,800	6,790	14,800
Korea, Republic of		7,120	9,060	9,100	10,100
Mexico		8,560	13,900	16,400	25,300
Netherlands		30	85	5,350	8,570
Norway		5,650	8,650	5,630	8,610
Singapore		962	1,470	2,240	3,580
Slovenia		1,810	2,700	--	--
South Africa		9,300	15,300	3,260	5,300
Spain		9,060	14,400	8,750	12,600
United Kingdom		13,600	21,700	7,770	11,600
Other		912 r	1,270 r	3,140	4,650
Total		198,000	315,000	199,000	312,000
Other titanium dioxide:	3206.19.0000				
Austria		16	234	29	362
Belgium		18	56	77	283
Brazil		142	197	65	87
Canada		2,370	7,830	1,960	7,900
China		736	1,080	1,070	1,630
Finland		113	1,380	178	1,880
France		103	351	56	318
Germany		668	1,900	547	1,550
India		146	487	341	913
Japan		300	4,790	436	5,760
United Kingdom		188	3,470	161	3,270
Other		314	1,270	460	2,280
Total		5,120	23,000	5,370	26,200
Unfinished titanium dioxide:[3]	2328.00.0000				
Brazil		100	145	88	127
China		10,700	11,400	10,800	11,600
Czech Republic		3,250	5,170	5,350	8,220
France		14,700	21,700	17,400	24,300
Germany		4,730	12,300	9,980	18,500
Japan		999	3,100	809	3,540
Korea, Republic of		336	474	424	521
Mexico		126	289	74	212
Poland		2,200	3,250	580	931
Other		460	1,010	13,700	6,810
Total		37,600	58,800	59,300	74,800
Grand total		241,000	397,000	264,000	413,000

[r]Revised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Unmixed and not surface treated.

Source: U.S. Census Bureau.

TABLE 15

TITANIUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY[1, 2]

(Metric tons)

Concentrate type and country	2000	2001	2002	2003	2004
Ilmenite and leucoxene:[3, 4]					
Australia:					
Ilmenite	2,146,000	2,017,000	1,917,000	2,006,000 r	1,921,000
Leucoxene	27,000	30,000	39,000	57,000	45,000
Brazil[5]	123,000	164,644 r	177,027 r	169,852 r	170,000 e
China[e]	250,000	300,000	750,000	800,000	840,000
Egypt[e]	125,000	125,000	125,000	125,000	125,000
India[e]	380,000	430,000	460,000	500,000	520,000
Malaysia	124,801	129,750	106,046	95,148	100,000 e
Norway[e]	750,000	750,000	750,000	840,000 r	860,000
Ukraine[e]	436,000 r	485,000 r	512,000 r	421,000 r	370,000
United States[6]	400,000	500,000	400,000	500,000 e	500,000 e
Vietnam[e]	174,000	180,000	180,000	180,000	190,000
Total[7]	4,940,000 r	5,110,000 r	5,420,000 r	5,690,000 r	5,640,000
Rutile:[4]					
Australia	208,000	206,000	218,000	173,000	162,000
Brazil[5]	3,162	2,270 r	1,878 r	2,337 r	2,350 e
India[e]	17,000	19,000	18,000	18,000	19,000
South Africa[e]	122,000 r	134,000 r	138,000 r	108,000 r	110,000
Ukraine[e]	58,600	60,000	70,000	60,000	60,000
United States	(8)	(8)	(8)	(8)	(8)
Total	409,000 r	421,000 r	446,000 r	361,000 r	353,000
Titaniferous slag:[e, 9]					
Canada	910,000 r	1,010,000 r	900,000	873,000 r	865,000
South Africa	1,090,000 r	1,025,000 r	973,000 r	1,010,000 r	1,020,000
Total	2,000,000 r	2,040,000	1,870,000 r	1,880,000 r	1,890,000

[e]Estimated. [r]Revised.

[1]Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through July 15, 2005.

[3]Ilmenite is also produced in Canada and South Africa, but this output is not included here because most of it is duplicative of output reported under "Titaniferous slag," and the rest is used for purposes other than production of titanium commodities, principally steel furnace flux and heavy aggregate.

[4]Small amounts of titanium minerals were reportedly produced in various countries; information, however, is inadequate to make reliable estimates of output levels.

[5]Excludes production of unbeneficiated anatase ore.

[6]Includes rutile to avoid disclosing company proprietary data. Rounded to one significant digit.

[7]Includes U.S. production, rounded to one significant digit, of ilmenite, leucoxene, and rutile to avoid disclosing company proprietary data.

[8]Included with ilmenite to avoid disclosing company proprietary data.

[9]Slag is also produced in Norway, Kazakhstan, and Russia, but this output is not included under "Titaniferous slag" to avoid duplicative reporting.