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2017 Minerals Yearbook

IRON OXIDE PIGMENTS [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

April 2020

Iron Oxide Pigments

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In 2017, natural crude iron oxide pigment (IOP) production in the United States decreased compared with that of 2016. The actual U.S. production data were withheld to avoid disclosing company proprietary data. Finished natural and synthetic IOPs sold by processors slightly decreased to 47,900 metric tons (t) valued at $69.1 million in 2017 from 48,500 t valued at $71.0 million in 2016 (table 1). Exports of pigment-grade iron oxides decreased by nearly 15% to 13,500 t valued at $36.4 million in 2017 compared with 15,800 t valued at $45.6 million in 2016; however, exports were still 51% higher than those in 2015. Imports of natural and synthetic IOPs were unchanged at 179,000 t but were valued slightly higher at $200 million in 2017 compared with $197 million in 2016 (tables 1, 4, 5).

Natural IOPs are inorganic compounds that are suitable for use as pigments after milling and minimal processing. They commonly are the preferred choice of the natural minerals for pigmentation because they are low cost, inherently color stable, and nontoxic. Typically, these pigments derive from hematite (Fe_2O_3), a red iron oxide mineral; goethite or limonite (Fe-OH), minerals that vary from yellow to brown, which include ochers and siennas (yellow) and umbers (brown); and magnetite (Fe_3O_4), a black iron oxide mineral. A wider variety of colors can be produced from natural IOPs by blending various IOPs or by calcination of hydrated natural IOPs.

Synthetic IOPs are widely used as colorants and compete with natural IOPs in many color applications, in part because synthetic IOPs duplicate colors more precisely and produce a substantially more diverse variety of colors. They are manufactured using the following three methods: precipitation of iron salts, usually accompanied by oxidation; reduction of organic compounds by iron; and thermal decomposition of iron salts or iron compounds. Organic colorants can be used for some applications, but they tend to fade over time from exposure to sunlight.

Production

Domestic production data for natural crude IOPs were derived from voluntary responses to a U.S. Geological Survey (USGS) canvass of three domestic producers. U.S. production data for crude (natural) IOPs sold or used in 2017 were developed using reported data from two of the three companies. Production for the third was estimated in part on the basis of annual worker-hour reports from the U.S. Department of Labor's Mine Safety and Health Administration. Domestic production data for natural crude IOPs are withheld from publication to avoid disclosing company proprietary data. In 2017, the leading producer continued mining natural crude IOPs at a slightly lower rate than in 2016, when it had resumed production following several years of mostly withdrawing from its stockpiles.

In another voluntary USGS survey, sales data for finished (natural and synthetic) IOPs were received from eight of nine known processing operations, representing more than 90% of the tonnage shown in table 1. Data for the nonrespondent were estimated on the basis of prior-year sales levels and industry trends. Sales of finished pigments were 47,900 t in 2017, down slightly from 48,500 t in 2016. Sales data for finished IOPs were collected only from operations that process material, such as the crushing and grinding of natural IOPs, or that make synthetic IOPs, not operations that blend, mix, repackage, and (or) resell IOP material.

Four U.S. companies, operating nine plants, produced regenerated iron oxide during steelmaking (table 2). Iron oxide is obtained during steelmaking when steel is treated with hydrochloric acid to remove surface oxides. Iron oxide is separated from the spent pickle liquor when it is treated to recycle the acid and reduce waste. One company produced iron oxide pigments mostly by recovering iron oxide from waste streams and drainage, and iron-bearing waste piles from current and closed coal and iron ore mines, especially in the Eastern States. Regenerated iron oxide data were not included in table 1 because the iron oxide is not natural (mined) or synthetic (manufactured) and must undergo additional processing before being suitable for use in typical IOP applications.

In August, Texas-based Huntsman Corp., a global specialty chemical company, spun off its Pigments & Additives Division to form Venator Materials PLC (Huntsman International LLC, 2017). Venator Materials continued to ramp up production at its new $172 million synthetic IOP production plant (previously owned by Rockwood Pigments NA, Inc.) near Augusta, GA. Production included black, red, and yellow synthetic IOPs at the 30,000-metric-ton-per-year (t/yr) advanced technology facility, the first new synthetic IOP plant built in the United States in nearly 35 years. Venator Materials expected to concentrate production of IOPs at the new facility in Georgia by 2020 (Rausch, 2015). Venator continued to produce synthetic IOPs at three other plant locations— Beltsville, MD; East St. Louis, MO; and Easton, PA (table 2). The East St. Louis plant produced synthetic IOPs but was tentatively slated for closure in September 2017 or soon after that, and the Easton plant, although technically closed, continued to produce from its stocks of raw materials. The Beltsville plant remained open, manufacturing synthetic IOPs, and production at the Augusta plant increased as the company worked through some remaining technology issues that were encountered in bringing the new plant into full operation (Venator Materials PLC, 2017).

Hong Kong-based Cathay Industries Group acquired Hoover Color Corp. (Hiwassee, VA) in 2017. Hoover Color produced natural and blended iron oxide pigments mostly by recovering iron oxide from waste streams and drainage as well as iron-bearing waste piles from current and closed coal

and iron ore mines, especially in the Eastern States. Hoover produced transparent iron oxides that were marketed as being "comparable to synthetically produced transparent iron oxides." Among the company's products were semitransparent umbers for wood coatings that leave the coated wood structure visible, other raw umbers for use as neutral toners in tinting systems, and burnt umbers able to withstand temperatures up to 315 degrees Celsius (Cathay Industries Europe N.V., 2017). Subsequently, Hoover Color partnered with the Commonwealth of Virginia in 2017 to transform 100 hectares (250 acres) of its mine property, including the colorful Hoover Color canyon mine site, into an extension of the New River Trail State Park. Access to the Hoover Mountain Biking Park by hiking and biking trails was scheduled to begin in 2018 (Clauson-Wicker, 2017).

Consumption

The USGS obtained end-use data in the survey of finished (natural and synthetic) IOP producers. Of the 47,900 t finished natural and synthetic IOPs that were sold or used by processors, an estimated 55% of sales were for use in concrete and other construction products; 19% in paints and coatings; 6% for foundry sands and other foundry uses; 3% each in animal foods and industrial chemicals; 2% each in cosmetics and plastics; 1% in glass and ceramics; and the remainder in other uses.

The leading use of IOPs was in construction materials in various products, including concrete products such as block, brick, or segmental retaining wall units; decorative concrete; mortar; paving stones; precast products of various sizes or dimensions; ready-mixed concrete; and roofing tiles. Tinted concrete is often stamped to resemble brick, slate, stone, and many more shapes and forms found in nature, including wood (Pinto, 2008, p. 4, 6).

The second-ranked market for IOPs was as a tint in paints and coatings. Other end uses included colorants for ceramics, glass, paper, plastics, rubber, and textiles; in animal feed; in cosmetics; in fertilizers; in other-than-colorant uses in ferrites; in foundry sands; in industrial chemicals, such as catalysts; and in magnetic ink and toner.

A significant end use for regenerator iron oxides was in ferrite ceramic magnets. Two types of ferrites are used—hard, which retain magnetism permanently, and soft, which do not. Hard ferrites are used in flexible magnets, generators, loudspeakers, and motors. Soft ferrites are used in computers, cores for radio frequency coils, microwave communication systems, microwave ferrites for telecommunications, and other industrial applications. Other end uses for regenerator iron oxides include color pigments in construction materials, cosmetic preparations, dyes and paints, and plastic products.

Prices

The annual average Producer Price Index (PPI) for IOPs (U.S. Bureau of Labor Statistics Series ID WPU06220206) was 249.9 in 2017 compared with 238.9 in 2016. The PPI measured the average change in the selling prices charged by domestic producers of IOPs over time. The PPI was 244.5 in January through May and 253.8 in June through December. Unit values for finished natural and synthetic IOPs reported by domestic producers ranged from $0.38 to $3.92 per kilogram, with an average unit value of $1.44 per kilogram (U.S. Bureau of Labor Statistics, 2018).

Foreign Trade

U.S. exports of pigment-grade iron oxides decreased by 15% to 13,500 t valued at $36.4 million in 2017, and the unit value decreased by about 7% (tables 1, 3). Mexico was the leading destination, accounting for 32% of United States exports, followed by China, 24%; Belgium, 14%; Germany, 7%; and Brazil, Chile, and Taiwan, about 4% each (table 3). Exports of other grades of iron oxides and hydroxides decreased by nearly 17% to 39,800 t in 2017 with a total value of $23.6 million; the average unit value increased by 9%. Spain, China, Canada, Mexico, Israel, and Australia were the major destinations for export of other grades of IOPs and hydroxides, accounting for about 41%, 31%, 11%, 7%, 4%, and 4% of the export tonnage, respectively (table 3).

U.S. imports of all IOPs and hydroxides were unchanged at 179,000 t in 2017 from those of 2016 (tables 1, 4). Imports of natural IOPs decreased by 53% to 3,340 t. The leading source of natural IOP imports was Cyprus, with 51% of the tonnage, followed by Austria with 20%; France, 15%; Germany, 7%; and Spain, 6%. Imports of synthetic IOPs increased slightly to 175,000 t. The leading sources of synthetic IOP imports were China with 52% of the tonnage; Germany, 30%; Brazil, 6%; Canada, 4%; and Italy, 3% (table 5).

World Review

Natural IOPs were produced in at least nine countries in 2017 (table 6). A significant number of other countries were thought to produce IOPs, but output, which may have been substantial, was not reported, and no basis was available for estimating output levels. World production in 2017 was essentially unchanged as compared with 2016.

Austria.—In 2017, Kärntner Montanindustrie GmbH continued production of micaceous iron oxide (MIO) from its underground mine and nearby processing plant in Waldenstein, State of Carinthia, from which it exported about 95% of its MIO products to the global market. Its products were exported to as many as 80 countries (Kärntner Montanindustrie GmbH, 2018, p. 12).

The U.S. Census Bureau reported United States imports of 655 t MIOs from Austria in 2017, an increase from 532 t in 2016 (table 5). MIOs have a horizontal layering of flaky, lamellar, "micaceous" particles that overlap like scales on a fish and give strength and corrosion resistance to paints and coatings. Standard-grade MIOs are used on bridges, oil rigs, and other structural steel and as protective coatings on electrical and industrial equipment. Micronized grades are used in anticorrosive decorative surfaces, including water-based coatings; in prime coatings, as partial replacement of zinc dust; and in applications requiring a degree of friction (O'Driscoll, 2012).

Brazil.—Lanxess AG was expanding production capacity for yellow iron oxide pigments by 2,000 t/yr through modernization of its production facility in Porto Feliz (Ondrey, 2017).

China.—After 6 years of increased imports of IOPs from the United States, averaging about 31,600 t/yr and reaching a high of nearly 40,000 t in 2015, imports decreased to 23,900 t in 2016 and 15,500 t in 2017, suggesting increased production of IOPs in China to supply the demand for IOPs driven by the country's increasing construction activity (table 3).

Cathay Industries Group, in a joint venture with the Tonghua Group, produced synthetic IOPs (black, red, and yellow) at its new 65,000-t/yr synthetic iron oxide plant in Tongling, Anhui Province, eastern China. The plant included spray driers capable of producing 20,000 t/yr of pigment granules (Cathay Industries Australasia Pty Ltd., 2016). Phase two of a multiphase expansion for increasing the capacity by another 20,000 t/yr at the joint-venture plant, known as Rely Science & Technology Co., Ltd., continued; completion of all planned phases was expected to increase capacity to 150,000 t/yr. Phase two, the commissioning of which was supposed to take place in 2018, was to include 10,000 t/yr of yellow IOP and 5,000 t/yr of red IOP capacity for coatings and paint products and 5,000 t/yr of high-purity black, red, and yellow IOP for use in food, personal care, and pharmaceutical products (Cathay Industries Australasia Pty Ltd., 2016). Products were targeted for markets in China, where demand had been increasing at a rate of 7% to 8% per year in most IOP-consuming industries. The new plant was designed to use a new process, designed to enhance water and waste gas treatment and significantly reduce the liquid and solid waste. This plant was Cathay Industries' eighth IOP plant in China, along with those in Shenzhen, Guangdong Province; Shanghai, Shanghai Province; and Wuxi, Anhui Province (Cathay Industries Europe N.V., 2013; Ollett, 2013a; Lismore-Scott, 2014).

Lanxess AG produced IOPs at its 25,000-t/yr red synthetic IOP plant and its 70,000-t/yr inorganic pigment mixing and milling plant at the Ningbo Chemical Park in Ningbo, Zhejiang Province. Highly saturated red IOPs and yellowish-red IOPs referred to by the company as the "New Reds" were produced using a newly patented "Ningbo Process," developed specifically for this plant that places emphasis on water treatment; waste gas cleaning, including a reduction of nitrous oxides generated; and lower energy consumption (Lanxess AG, 2017, p. 44–45, 115). Lanxess also operated a 38,000-t/yr IOP plant in Jinshan, Shanghai Province, where it produced black and yellow IOPs (Ollett, 2013b, c; Sun, 2015).

Germany.—Lanxess AG announced plans to gradually increase production capacities for red and black pigments at its Krefeld-Uerdingen synthetic iron oxide plant by about 23,000 t/yr by 2019 from its 2017 production capacity of 280,000 t/yr (Ondrey, 2017).

Spain.—Promindsa SA, the country's leading producer of IOPs, produced and sold nearly 16,000 t of IOP in 2017, up from 15,000 t of IOPs in 2016; 85% of production was exported to 79 countries worldwide. The company expected to increase mine production and sales by 2,000 to 3,000 t in 2018 owing to Promindsa's new range of products called Micronox BIOX™ and Micronox ON16™ for use in construction, ceramic products, and environmental treatments. About 80% of Promindsa's IOP output and sales was red hematite, mostly from its 100-year-old Santa Rosa Mine. Promindsa sold its Santa Rosa iron oxide as a red pigment for use in asphalt, brick, glass and ceramics, paints, and roof tile. The company mined other deposits in the Provinces of Soria, Granada, Cordoba, Teruel, and Zaragoza in Spain, from which it produced black (magnetite), brown (oolitic iron ore), and yellow (goethite) IOPs (Promindsa SA, 2013). Promindsa also operated the Ojos Negros Mine, a goethite iron ore project from which the company produced 1,500 t of brown IOP in 2017 (Fernando Prada, President, Promindsa SA, written commun., July 21, 2017).

Also, in 2017, Promindsa continued production of the two ranges of products at business units formed in 2015. One was a line of color dispersion products for use in paints, agriculture, plastics, rubber, and cork, and the other included Micronox BIOX™ and Micronox ON16™ for the treatment and decontamination of contaminated soils or materials (Fernando Prada, President, Promindsa SA, written commun., July 21, 2017; Promindsa SA, 2017).

Outlook

New residential construction and commercial and residential remodeling are expected to continue to increase, creating higher consumption of IOPs as coloring agents in concrete products and ceramic tiles. This expected increase is partly owing to an increase in construction and refurbishment projects resulting from significant damage to structures that took place in 2017 as the result of extensive hurricanes along the gulf coast and the southeastern United States and extensive wildfires in some Western States.

With the overall global economy continuing to gradually increase, construction activity and consequent consumption of IOPs for coloring concrete, and paints and coatings, are expected to follow.

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TABLE 1
SALIENT U.S. IRON OXIDE PIGMENTS STATISTICS[1]

		2013	2014	2015	2016	2017
Crude pigments sold or used:[2]						
Quantity		W	W	W	W	W
Value		W	W	W	W	W
Finished pigments sold:[3]						
Quantity	metric tons	47,200	45,300	53,500	48,500 r	47,900
Value	thousands	$75,400	$71,500	$77,900	$71,000 r	$69,100
Exports:[4]						
Quantity	metric tons	8,170	8,790	8,930	15,800	13,500
Value	thousands	$13,400	$16,000	$17,200	$45,600	$36,400
Imports for consumption:[3]						
Quantity	metric tons	165,000	175,000	176,000	179,000	179,000
Value	thousands	$190,000	$208,000	$209,000	$197,000	$200,000
World, production	metric tons	1,750,000	2,720,000	2,480,000	2,510,000 r	2,500,000

rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through May 31, 2019. Data are rounded to no more than three significant digits.
[2]Mined.
[3]Natural (mined) and synthetic.
[4]Pigment grade.

TABLE 2
PRODUCERS OF IRON OXIDE PIGMENTS AND REGENERATED IRON OXIDES
IN THE UNITED STATES IN 2017[1]

Producers	Plant location
Pigments:	
Crude:	
Alabama Pigments Co., LLC	Green Pond, AL.
Applied Minerals, Inc.	Eureka, UT.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Finished:	
Alabama Pigments Co., LLC	Green Pond, AL.
Dynamic Color Solutions, Inc.	Milwaukee, WI.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Prince Minerals, Inc.	Quincy, IL; and Bowmanstown, PA.
Venator Materials PLC (formerly Huntsman Corp.)	Augusta, GA; Beltsville, MD; East St. Louis, MO; and Easton, PA.
Regenerator iron oxides:	
American Iron Oxide Co.[2]	Portage, IN; Rockport, IN; and Allenport, PA.
ArcelorMittal Weirton Inc.	Weirton, WV.
Bailey-PVS Oxides, LLC	Decatur, AL; Fairfield, AL; and Delta, OH.
International Steel Services, Inc.	Burns Harbor, IN; and Warren, OH.

[1]Table includes data available through May 31, 2019.
[2]Division of International Steel Services, Inc.

TABLE 3
U.S. EXPORTS OF IRON OXIDES AND HYDROXIDES, BY COUNTRY OR LOCALITY[1]

	Pigment grade				Other grade			
	2016		2017		2016		2017	
Country or locality	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	6	$22	10	$47	1	$9	49	$623
Australia	80	233	84	211	629	530	1,400	865
Austria	4	9	--	--	--	--	1	10
Belgium	5,820	28,100	1,930	14,600	96	476	74	395
Brazil	545	1,650	544	1,740	207	239	158	561
Canada	9	14	8	11	3,910 r	8,490 r	4,420	9,650
Chile	245	252	563	659	20	255	11	128
China	2,710	3,870	3,290	5,420	21,200	6,410 r	12,200	3,500
Colombia	57	245	90	395	4	91	47	173
Czechia	(2)	5 r	--	--	12	184	7	100
Dominican Republic	6	24	1	4	2	8	--	--
Ecuador	--	--	1	13	1	29	--	--
France	68	325	45	246	4	18	--	--
Germany	88	764	897	4,690	16	79	(2)	16
Guatemala	14	24	13	22	--	--	(2)	13
Guyana	8	54	7	37	--	--	--	--
Haiti	3	11	5	23	4	15	3	11
Honduras	--	--	--	--	6	24	(2)	18
Hong Kong	50	196	10	56	1	29	2	23
India	171	602	196	594	159	687	6	72
Indonesia	18	44	6	27	8	85	5	81
Ireland	19	30	10	35	--	--	--	--
Israel	2	35	6	22	1,840	578	1,670	534
Italy	23	58	69	159	78	38	80	19
Jamaica	--	--	2	9	4	19	2	7
Japan	7	50	20	80	13	16	86	22
Korea, Republic of	118	722	128	685	18	255	51	611
Lebanon	4	20	2	5	--	--	--	--
Malaysia	19	10	5	11	5	51	4	29
Mexico	4,250	2,860	4,260	2,970	2,680	1,980	2,820	2,160
Netherlands	--	--	--	--	475	252	--	--
New Zealand	10	47	7	51	1	11	108	127
Peru	3	14	2	12	17	29	19	13
Philippines	--	--	1	10	(2)	11	1	19
Russia	--	--	19	9	14	10	35	20
Singapore	2	15	5	34	52	143	10	133
South Africa	6	35	3	22	2	4	2	3
Spain	54	188	18	76	16,000	3,280	16,200	2,640
Taiwan	471	1,500	589	1,470	57	524	11	195
Thailand	42	139	177	214	95	583	2	13
Trinidad and Tobago	6	31	6	29	33	28	2	15
United Kingdom	610	2,630	320	1,500	127	555	166	522
Uruguay	238	653	22	88	--	--	63	182
Venezuela	6	16	--	--	--	--	6	19
Other	31 r	67 r	127	98	20 r	78 r	1	75
Total	15,800	45,600	13,500	36,400	47,800	26,100	39,800	23,600

rRevised. -- Zero.
[1]Table includes data available through May 31, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 4
U.S. IMPORTS FOR CONSUMPTION OF SELECTED IRON OXIDE AND HYDROXIDE PIGMENTS, BY TYPE[1]

Type	2016 Quantity (metric tons)	2016 Value[2] (thousands)	2017 Quantity (metric tons)	2017 Value[2] (thousands)	Principal sources, 2017 (metric tons)
Natural:					
Earth colors[3]	6,120	$2,070	1,840	$901	Cyprus, 1,680; Spain, 143.
Micaceous	989	1,410	1,500	1,820	Austria, 655; France, 506; Germany, 228.
Total	7,110	3,480	3,340	2,720	
Synthetic:					
Black	48,100	46,800	48,100	46,800	Germany, 21,000; China, 17,800; Canada, 6,480; Italy, 2,380.
Red	70,100	80,000	73,700	83,600	China, 46,400; Germany, 20,900; Italy, 1,550; India, 1,500.
Yellow	52,400	64,400	52,600	65,600	China, 26,700; Germany, 11,300; Brazil, 11,200.
Other[4]	1,430	2,060 r	995	1,620	China, 740; Canada, 140.
Total	172,000	193,000	175,000	198,000	
Grand total	179,000	197,000	179,000	200,000	

rRevised.
[1]Table includes data available through May 31, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Includes those not elsewhere specified or included.
[4]Includes synthetic brown oxides, transparent oxides, and magnetic and precursor oxides.

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF IRON OXIDE AND HYDROXIDE PIGMENTS, BY COUNTRY OR LOCALITY[1]

	Natural				Synthetic			
	2016		2017		2016		2017	
Country or locality	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)
Australia	--	--	--	--	18	$14	--	--
Austria	532	$1,020	655	$1,130	7	38	--	--
Belgium	--	--	(3)	3	39	29	40	$53
Brazil	--	--	--	--	12,300	16,300	11,200	15,000
Canada	--	--	(3)	5	8,170	4,290	7,400	4,790
China	21	22	9	16	86,700	86,600 r	91,700	92,200
Colombia	--	--	--	--	2,180 r	2,640 r	1,770	2,290
Cyprus	1,960	1,090	1,690	828	--	--	213	220
France	376	341	511	411	256	1,970	239	1,630
Germany	--	--	228	210	49,100	59,100 r	53,200	63,600
Hong Kong	--	--	--	--	552	718	197	295
India	--	--	--	--	2,860	1,500	1,950	1,170
Italy	3	11	4	15	7,780	14,400	5,520	11,200
Japan	(3) r	4 r	(3)	5	1,420	4,890	1,190	3,970
Korea, Republic of	--	--	--	--	1	46	32	349
Mexico	(3) r	13	20	18	--	--	--	--
Netherlands	4	32	5	3	50	85	61	77
Norway	--	--	--	--	37	29	55	42
South Africa	--	--	--	--	1	21	1	23
Spain	4,210	945	214	70	530	294	627	338
Taiwan	--	--	--	--	48	87	80	168
United Kingdom	--	--	--	--	7 r	78	13	200
Other	(3)	5 r	2	9	(3) r	7 r	2	4
Total	7,110	3,480	3,340	2,720	172,000	193,000	175,000	198,000

rRevised. -- Zero.
[1]Table includes data available through May 31, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6
NATURAL IRON OXIDE PIGMENTS: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Metric tons)

Country or locality[2]	2013	2014	2015	2016	2017
Austria, micaceous iron oxide	3,500	3,500	3,500	3,500	3,500 e
Cyprus, umber	4,016	3,793	3,503	3,816 r	4,000 e
France	900	900	1,000	1,000 e	1,000 e
Germany	205,000 e	200,000	200,000	200,000 e	200,000
India, ocher[3]	1,490,033	2,467,767	2,203,708	2,200,000 e	2,200,000 e
Italy	25 r	30 r	38 r	36 r	40 e
Pakistan, ocher[4]	31,873	27,507	51,534	90,424 r	80,000 e
Spain, ocher and red iron oxide	16,400	16,000	16,000	16,000 e	16,000 e
United States	W	W	W	W	W
Total	1,750,000	2,720,000	2,480,000	2,510,000 r	2,500,000

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Table includes data available through June 26, 2018. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

[2]In addition to the countries and (or) localities listed, Azerbaijan, Brazil, China, Honduras, Iran, Kazakhstan, Lithuania, Paraguay, Russia, Turkey, Ukraine, and the United Kingdom may have produced iron oxide pigments, but available information was inadequate to make reliable estimates of output.

[3]Production is based on fiscal year, with a starting date of March 31 of the year shown.

[4]Production is based on fiscal year, with a starting date of June 30 of the year shown.