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IRON OXIDE PIGMENTS

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Iron Oxide Pigments

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In 2005, total iron oxide pigment (IOP) production, using partially estimated data, increased by 6% to 90,000 metric tons (t) valued at $93.4 million. Exports of IOPs decreased to 2,220 t valued at $6.2 million. IOP imports increased by 14% to 193,000 t with China as the leading supplier.

Natural iron oxide pigments are derived from hematite, which is a red iron oxide mineral; limonites, which vary from yellow to brown, such as ochers, siennas, and umbers; and magnetite, which is black iron oxide. Synthetic iron oxide pigments are produced from basic chemicals. The three major methods for the manufacture of synthetic iron oxides are thermal decomposition of iron salts or iron compounds; precipitation of iron salts, usually accompanied by oxidation; and reduction of organic compounds by iron (Podolsky and Reid, 2006, p. 1458).

Production

U.S. production data for crude (natural) IOPs sold or used in 2005 were developed by the U.S. Geological Survey (USGS) from a voluntary survey of four companies, of which three responded. Data are withheld to avoid disclosing company proprietary data. In a second voluntary survey, data were received from 6 of 12 known processing operations for finished (natural and synthetic) IOPs. By tonnage, the six operations represented 47% of the output in tables 1 and 2. Data for nonrespondents were estimated on the basis of prior-year levels of output.

At least three U.S. companies produced regenerated iron oxide, which is obtained when spent pickle liquor from steelmaking is treated (table 3). Regenerator iron oxide data were not included in tables 1 and 2. A major end use for this material was ferrites, which are magnetic ceramic oxides. There are two types of ferrites—soft, which do not retain permanent magnetism, and hard, which retain permanent magnetism. Uses of soft ferrites include computers, cores for radio frequency coils, inverter cores, memory cores, microwave communication systems, microwave ferrites for telecommunications, pot cores, rectangular modulus cores, television deflection yokes, and other industrial applications. Hard ferrites are used in flexible magnets, generators, loudspeakers, and motors.

Elementis Pigments Inc. (a division of Elementis plc) scaled down production of IOPs at its East St. Louis, IL, plant and transferred production to its recently commissioned plant in Tai Cang, China. Other production was to be accommodated at its Easton, PA, plant. The company noted that its coatings market showed growth in Asia but demand was relatively flat in Europe and the United States (Industrial Minerals, 2005a; Elementis plc, 2006§[1]).

In restructuring activities, Lanxess AG announced the shutting down of its New Martinsville, WV, production of yellow IOPs. Production was to cease in mid-2006, and closing the plant's operations was to take place in 2007. In the future, customers were to be supplied from the company's operations in Porto Feliz, Brazil, and Uerdingen, Germany (Lanxess AG, undated §).

Azco Mining Inc. of Glendale, CA, reacquired 100% interest in a mineral lease with New Planet Copper Mining Co. that is claimed to contain a major occurrence of micaceous iron oxide (MIO). A major application of MIO is as an anticorrosion agent in paint. The company's proposed new operation would produce MIO pigment for domestic and overseas paint markets (Industrial Minerals, 2005b).

Consumption

Although data were not available, construction materials and paints and coatings have been the leading end uses of IOPs. Construction applications included such concrete products as block, brick, or segmental retaining wall units; mortar; paving stones; precast products of various sizes or dimensions; ready-mixed concrete; and roofing tiles. Shipments of total paint and coatings (comprising architectural coatings, original equipment manufacture product coatings, and special-purpose coatings) were approximately the same in 2005 as in 2004 (U.S. Census Bureau, 2006§).

Other end uses of IOPs included as colorants for ceramics, glass, paper, plastics, rubber, and textiles; in foundry sands; and industrial chemicals, such as catalysts. Other applications were animal feed, cosmetics, ferrites, fertilizers, and magnetic ink and toner.

Prices

Lanxess announced price increases in December of an average of 5% to 8% for its synthetic IOPs. The company cited increases in the cost of energy, fuel, and other raw materials as the reasons for the price increases (Lanxess AG, 2005§).

Effective November 1, Rockwood Pigments NA, Inc. announced plans to raise prices for its IOPs by an average of 10% and to pass on freight surcharges imposed by domestic carriers. The company noted increases in energy, raw materials, and transportation costs as the reasons for the actions (Rockwood Specialties Group, Inc., 2005§).

The average annual producer price index (PPI) for IOPs for 2005 was 191.3 compared with 180.2 in 2004. The PPI measures the average change in the selling prices charged by domestic producers of IOPs over time. The baseline for the IOP PPI is June 1983 (U.S. Bureau of Labor Statistics, 2006§).

Foreign Trade

U.S. exports of pigment-grade IOPs in 2005 totaled 2,220 t compared with 3,120 t in 2004 (table 4).

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

U.S. imports of IOPs of 193,000 t in 2005 were 14% higher than those of 2004 (table 5). By tonnage, the three leading sources of IOP imports were China with 60%; Germany, 22% and Italy, 5% (table 6). The average value of total U.S. imports of synthetic IOPs from China was $599 per metric ton in 2005 compared with $545 per ton in 2004. The average value of total U.S. imports of synthetic IOPs from all countries was $734 per ton in 2005 compared with $687 per ton in 2004.

World Review

India.—Selective Minerals® Color Industries Pvt. Ltd. has been manufacturing processed minerals including natural iron oxides (black, red, and yellow), from its operation near Mumbai for more than 25 years. Production was about 15,000 metric tons per year supplying such end uses as ceramics, construction, ferrites, glass, paint, and plastics. Major export markets include Africa, Europe, the Far East, and the Middle East (Industrial Minerals, 2005c).

Sweden.—IOPs were used in the new Arsta Bridge, which opened in August, that handles train traffic to and from Stockholm's Central Station. The 833-meter-long bridge contains concrete that is colored with 350 t of red-brown IOPs, which is the traditional color of houses in Sweden (Lanxess AG, 2006§).

Outlook

During the past several years, the color pigments industry has gone through a period of restructuring, responding to the globalization of pigment markets. Other challenges include maturing markets in some applications and regions. Production of lower to medium-value IOPs could continue to shift to lower cost countries, such as China and India (Will, Schlag, and Kishi, 2004, p. 575.0000 P–575.0000 Q).

Future developments could include nanosized (less than 0.1 micron) materials and new chemical applications, with concrete/construction and paint/coatings usage continuing as dominant end uses (Podolsky and Reid, 2006, p. 1462-1463).

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

		2001	2002	2003	2004	2005
Crude pigments sold or used:[2]						
Quantity	metric tons	61,500	W	W	W	W
Value	thousands	$3,460	$1,070	W	W	W
Finished pigments sold:[3]						
Quantity	metric tons	135,000	115,000	90,000 e	85,000 e	90,000 e
Value	thousands	$130,000	$117,000	$89,000 e	$77,000 e	$93,400 e
Exports:						
Quantity	metric tons	9,100	6,270	4,500	3,120	2,220
Value	thousands	$16,800	$12,100	$11,000	$7,380	$6,170
Imports for consumption:						
Quantity	metric tons	89,900	132,000	140,000	170,000	193,000
Value	thousands	$76,900	$96,300	$96,600	$116,000	$140,000

[e]Estimated. W Withheld to avoid disclosing company proprietary data.
[1]Data are rounded to no more than three significant digits.
[2]Mined.
[3]Natural (mined) and synthetic.

TABLE 2
FINISHED IRON OXIDE PIGMENTS SOLD BY PROCESSORS IN THE UNITED STATES, BY KIND[1]

	2004		2005	
Kind	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Natural:				
Black, magnetite	W	W	W	W
Umbers:				
Burnt	W	W	W	W
Raw	W	W	W	W
Red, iron oxide[2]	W	W	W	W
Undistributed and other[3]	52,000	$20,000	52,000	$22,600
Total[e]	52,000	20,000	52,000	22,600
Synthetic:				
Black, iron oxide	--	--	W	W
Brown, iron oxide	W	W	W	W
Red, iron oxide	W	W	W	W
Yellow, iron oxide	21,300	35,600	22,800 e	36,600 e
Mixtures of natural and synthetic, iron oxides	W	W	W	W
Total	32,300	57,700	38,000 e	70,800 e
Grand total[e]	85,000	77,000	90,000	93,400

[e]Estimated. W Withheld to avoid disclosing company proprietary data; included with "Natural, undistributed and other" and "Synthetic, total." -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes pyrite cinder.
[3]Includes brown burnt sienna, ocher, raw sienna, and data indicated by symbol W.

TABLE 3
PRODUCERS OF IRON OXIDE PIGMENTS AND REGENERATOR IRON OXIDES IN THE UNITED STATES IN 2005

Producers	Plant location
Finished pigments:	
Alabama Pigments Co.	Green Pond, AL.
Dynamic Color Solutions, Inc.	Milwaukee, WI.
Elementis Pigments Inc.	East St. Louis, IL; and Easton, PA.
Hoover Color Corp.	Hiwassee, VA.
Lanxess Corp.	New Martinsville, WV.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Prince Manufacturing Co., Inc.	Quincy, IL; and Bowmanstown, PA.
Rockwood Pigments Inc.	Beltsville, MD; and St. Louis, MO.
Solomon Grind-Chem Services Inc.	Springfield, IL.
Crude pigments:	
Alabama Pigments Co.	Green Pond, AL.
Cleveland-Cliffs Iron Co., Mather Mine and Pioneer plant[1]	Negaunee, MI.
Hoover Color Corp.	Hiwassee, VA.
New Riverside Ochre Co., Inc.	Cartersville, GA.
Regenerator iron oxides:	
Bailey-PVS Oxides, L.L.C.	Decatur, AL; Fairfield, AL; Delta, OH.
International Steel Services, Inc.	Allenport, PA.
Weirton Steel Corp.	Weirton, WV.

[1]Closed July 31, 1979; shipping from stockpile.

TABLE 4
U.S. EXPORTS OF IRON OXIDES AND HYDROXIDES, BY COUNTRY[1]

	2004				2005			
	Pigment grade		Other grade		Pigment grade		Other grade	
Country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	17	$70	308	$595	1	$6	250	$577
Belgium	492	1,920	68	152	442	1,480	115	297
Brazil	16	90	232	254	76	377	93	294
Canada	39	50	11,100	12,600	26	39	10,300	11,700
China	219	275	43,600	8,080	299	469	43,800	12,700
Colombia	19	60	151	67	7	17	237	90
France	275	839	355	946	4	58	438	1,110
Germany	17	33	260	650	13	16	509	1,040
Hong Kong	84	109	1,500	2,040	85	194	2,490	1,810
India	170	349	320	311	85	179	308	332
Indonesia	46	37	115	207	--	--	113	132
Italy	--	--	1,910	1,240	19	44	785	835
Japan	52	80	710	500	37	27	980	1,260
Korea, Republic of	445	584	1,950	2,220	27	190	3,360	3,050
Malaysia	--	--	287	698		8	440	864
Mexico	437	492	1,690	1,610	174	295	1,260	951
Netherlands	8	20	643	1,180		3	439	845
Russia	296	668	220	411	195	345	246	413
Singapore	1	6	994	383	--	--	1,380	382
Taiwan	--	--	2,170	1,650	19	107	1,460	1,800
Thailand	18	29	918	334	--	--	890	348
United Kingdom	134	329	2,420	4,710	167	601	1,870	4,210
Other	335	1,350	769	1,050	548	1,710	1,290	2,100
Total	3,120	7,380	72,700	41,800	2,220	6,170	73,100	47,100

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF SELECTED IRON OXIDE PIGMENTS, BY TYPE[1]

Type	2004 Quantity (metric tons)	2004 Value[2] (thousands)	2005 Quantity (metric tons)	2005 Value[2] (thousands)	Principal sources, 2005 (metric tons)
Natural:					
Earth colors[3]	3,270	$1,410	3,780	$1,700	Cyprus, 3,480; Spain, 235; Germany, 68.
Micaceous	833	690	1,420	896	Spain, 794; France, 253; Austria, 219.
Total	4,100	2,100	5,200	2,590	
Synthetic:					
Black	41,700	31,100	48,600	35,700	China, 20,500; Germany, 17,100; Italy, 5,060 Canada, 2,440; Japan, 1,970; Mexico, 644; India, 542; Egypt, 156; Republic of Korea, 110.
Red	67,900	41,200	74,400	47,400	China, 52,700; Germany, 14,700; Italy, 1,540; Canada, 1,070; Japan, 906; Colombia, 511; Belgium, 502; Sweden, 327; Brazil, 177.
Yellow	52,600	36,700	61,500	49,400	China, 42,000; Germany, 9,920; Brazil, 3,900; Italy, 2,670; Colombia, 1,130; Mexico, 816; Canada, 527; India, 182; Hong Kong, 162.
Other[4]	3,330	4,950	3,360	5,030	China, 1,810; Canada, 551; Germany, 448; Japan, 414; France, 70.
Total	166,000	114,000	188,000	138,000	
Grand total	170,000	116,000	193,000	140,000	

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Includes those earth colors not elsewhere specified or included.
[4]Includes synthetic brown oxides, transparent oxides, and magnetic and precursor oxides.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF IRON OXIDE AND IRON HYDROXIDE PIGMENTS, BY COUNTRY[1]

Country	Natural 2004 Quantity (metric tons)	Natural 2004 Value[2] (thousands)	Natural 2005 Quantity (metric tons)	Natural 2005 Value[2] (thousands)	Synthetic 2004 Quantity (metric tons)	Synthetic 2004 Value[2] (thousands)	Synthetic 2005 Quantity (metric tons)	Synthetic 2005 Value[2] (thousands)
Austria	307	$309	219	$212	--	--	--	--
Belgium	9	12	--	--	533	$437	1,730	$612
Brazil	--	--	--	--	3,020	2,520	4,070	3,740
Canada	--	--	--	--	1,970	3,230	4,580	5,610
China	--	--	16	63	96,800	52,800	117,000	70,100
Colombia	--	--	--	--	1,190	1,330	1,680	2,040
Cyprus	3,030	1,230	3,480	1,510	20	10	--	--
France	54	32	253	167	246	818	196	830
Germany	197	239	106	136	43,700	29,600	42,200	33,100
Hong Kong	--	--	--	--	1,200	638	343	239
India	11	6	--	--	2,240	1,380	831	469
Italy	--	--	18	11	7,620	8,750	9,270	11,200
Japan	59	102	79	135	2,800	7,810	3,310	5,970
Mexico	--	--			2,540	2,200	1,550	1,530
Spain	279	87	1,030	362	418	202	145	75
Sweden	--	--	--	--	750	175	327	117
United Kingdom	--	--	--	--	274	1,840	211	1,690
Other	155	86	--	--	203	129	429	432
Total	4,100	2,100	5,200	2,600	166,000	114,000	188,000	138,000

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

Source: U.S. Census Bureau.

TABLE 7
NATURAL IRON OXIDE PIGMENTS: ESTIMATED WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2001	2002	2003	2004	2005
Austria	5,000	5,000	5,000	4,000	4,000
Brazil	2,000	2,000	2,000	2,000	2,000
Cyprus, umber	7,800 [4]	8,200 [4]	11,900 [4]	12,000	12,000
France	1,000	1,000	1,000	1,000	1,000
Germany	400	419 [4]	429 [4]	400 [r]	400
Honduras	70,941	71,000	71,000	71,000	71,000
India, ocher	355,000	360,000	365,000	360,000	360,000
Iran	1,000 [4]	2,300 [4]	2,300	2,500	2,500
Italy	500	500	500	500	500
Pakistan, ocher	4,800	4,500	4,500	4,500	4,500
Paraguay, ocher	300	300	250 [r]	250 [r]	250
South Africa	852 [4]	252 [4]	764 [r, 4]	512 [r, 4]	555 [4]
Spain, ocher	87,000	80,000	80,000	75,000	75,000
United States	61,500 [4]	W	W	W	W

[r]Revised. W Withheld to avoid disclosing company proprietary data.
[1]Estimated data are rounded to no more than three significant digits.
[2]Table includes data available through June 4, 2006.
[3]In addition to the countries listed, a number of others undoubtedly produce iron oxide pigments, but output is not reported and no basis is available for formulating estimates of output levels. Such countries include Azerbaijan, China, Kazakhstan, Russia, Turkey, and Ukraine. Unreported output is probably substantial.
[4]Reported figure.