DIAMOND, INDUSTRIAL

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Diamond is best known for its gem qualities, but some of its unique properties make it ideal for many industrial and research applications as well. Diamond is the hardest known material and has the highest thermal conductivity of any material at room temperature (May, 1995). Diamond is more than twice as hard as cubic boron nitride or silicon nitride, which are the nearest competitors (Ravi, 1994). Because it is the hardest substance known, diamond has been used for centuries as an abrasive in grinding, drilling, cutting, and polishing, and industrial-grade diamond continues to be used as an abrasive for many applications. Diamond that does not meet gem-quality standards for color, clarity, size, or shape is used as industrial-grade diamond. Even though it has higher unit cost, diamond has proven to be more cost-effective in many industrial processes because it cuts faster and lasts longer than any rival abrasive materials (Boucher, 1997). Diamond also has chemical, electrical, optical, and thermal characteristics that make it the best material available to industry for wear- and corrosion-resistant coatings, special lenses, heat sinks in electrical circuits, wire drawing, and advanced technologies.

Both synthetic and natural diamonds have industrial uses, but synthetic industrial diamond is superior to its natural diamond counterpart because it can be produced in large quantities. In many cases, its properties can be tailored for specific applications (Boucher, 1996). It is for these reasons that manufactured diamond accounts for more than 90% of the industrial diamond used in the United States and the world.

Legislation and Government Programs

Congress has authorized the sale of all the diamonds in the National Defense Stockpile (NDS), which is managed by the Department of Defense (DOD). The NDS 1999 annual plan allowed for the sale of all stockpiled bort and diamond dies and a portion of the stockpiled diamond stones. During 1999, NDS sold 599,136 carats of diamond stone (valued at $20.7 million); 62,557 carats of bort (valued at $335,545); and 25,446 diamond dies (valued at $148,445). At yearend 1999, NDS reported a remaining inventory of 2.497 million carats of industrial diamond stone (valued at $24.97 million) (Tom Meeker, Defense Logistics Agency, oral commun., 2000). DOD plans to conduct additional future sales until all NDS diamond stone stocks are exhausted.

Production

The U.S. Geological Survey conducts an annual survey of domestic industrial diamond producers and U.S. firms that recover diamond wastes. Although most of these companies responded to the 1999 survey, a few significant firms withheld certain data that they deemed confidential. Only estimates of U.S. primary and secondary output are provided in this review.

As one of the world's leading producers of synthetic industrial diamond, the United States accounted for an estimated output of 208 million carats in 1999. Only two U.S. companies produced synthetic industrial diamond during the year—Mypodiamond, Inc., Gibbstown, NJ, and GE Superabrasives, Worthington, OH. Mypodiamond, Inc. purchased the DuPont plant in May 1999. General Electric Co., Fairfield, CT, which owns GE Superabrasives and other diamond manufacturing plants abroad, is one of the world's largest producers of industrial diamond.

In 1999, nine firms also manufactured polycrystalline diamond (PCD) from synthetic diamond grit and powder. These companies were the Dennis Tool Co., Houston, TX; GE Superabrasives, Worthington, OH; Novatek Inc., Provo, UT; Phoenix Crystal Corp., Ann Arbor, MI; Precorp Inc., Provo, UT; SII Megadiamond Industries Inc., Provo, UT; Tempo Technology Corp., Somerset, NJ; U.S. Synthetic Corp., Orem, UT; and Western Diamond Products, Salt Lake City, UT.

About 10.1 million carats of used industrial diamond were recycled in the United States in 1999. Most of this material was recovered by recycling firms from used drill bits, diamond tools, and other diamond-containing wastes. Additional diamond was recovered during the year from residues generated in the manufacture of PCD; most of this material was recovered for PCD from their production operations (Wilson Born, National Research Company, oral commun., 2000).

The recovery and sale of industrial diamond was the principal business of four U.S. companies in 1999: Industrial Diamond Laboratory Inc., Bronx, NY; Industrial Diamond Powders Co., Pittsburgh, PA; International Diamond Services Inc., Houston, TX; and National Research Company, Fraser, MI. In addition to these companies, other domestic firms may recover industrial diamond in smaller secondary operations.

Consumption

In 1999, the United States continued to be the world's largest industrial diamond market. On the basis of economic indicators, such as production and trade data, estimated U.S. consumption of industrial diamond reached a record high of more than 330 million carats during the year. This growth in consumption primarily reflects expanded output in domestic industries where diamond is used. The following U.S. industry sectors were the principal consumers of industrial diamond in

1999: computer chip production, construction, machinery manufacturing, mining services (drilling), stone cutting/polishing, and transportation systems (infrastructure and vehicles). Within these sectors, stone cutting and highway building/repair together accounted for the largest demand. One and a half carats of industrial diamond reportedly are consumed in the production of every automobile made in the United States. Research and high technology uses included close-tolerance machining of ceramic parts for the aerospace industry, heat sinks in electronic circuits, lenses for laser radiation equipment, and polishing silicon wafers and disks drives in the computer industry (Bailey and Bex, 1995).

Diamond tools have a myriad of industrial functions. Diamond drilling bits and reaming shells are used principally for gas, mineral, and oil exploration. Other diamond bits and reaming shells applications include foundation testing, masonry drilling, and inspecting concrete in various structures. The primary uses of point diamond tools are for dressing and truing grinding wheels and for cutting, machining, boring, and finishing; beveling glass for automobile windows is another application. Cutting dimension stone and cutting/grooving concrete in highway reconditioning are the major uses of diamond saws; other applications include the cutting of composites and the forming of refractory shapes for furnace linings. Very fine diamond saws are used to slice brittle metals and crystals into thin wafers for electronic and electrical devices. Diamond wire dies are essential for high-speed drawing of fine wire, especially from hard, high-strength metals and alloys. The primary uses of diamond grinding wheels include edging plate glass, grinding dies, grinding parts for optical instruments, and sharpening and shaping of carbide machine tool tips.

Two types of natural diamond are used by industry: diamond stone (generally larger than 60 mesh/800 microns) and diamond bort (smaller, fragmented material). Diamond stone is employed primarily in drilling bits and reaming shells used by mining companies; it also is incorporated in single- or multiple-point diamond tools, diamond saws, diamond wheels, and diamond wire dies. Diamond bort is utilized for drilling bits and as a loose grain abrasive for polishing. Other tools that incorporate natural diamond include: engraving points, glass cutters, bearings, and surgical instruments.

Synthetic diamond grit and powder are used in diamond grinding wheels, saws, impregnated bits and tools, and as loose abrasive compounds for polishing. The diamond grinding wheels can be as much as 1 meter in diameter.

Loose powders and compounds made of synthetic diamond for polishing are used primarily to finish optical surfaces, jewel bearings, gemstones, wiredrawing dies, cutting tools, and silicon wafers for computer chips. Hundreds of other products made from metals, ceramics, plastics, and glass also are finished with diamond powders and compounds.

The use of polycrystalline diamond shapes (PDS) and polycrystalline diamond compacts (PDC) continues to increase for many of the applications cited above, including some of those that employ natural diamond. The use of PDS, PDC, and matrix-set synthetic diamond grit for drilling bits and reaming shells has increased in recent years. PDS and PDC are used in the manufacture of single- and multiple-point tools, and PDC is used in a majority of the diamond wire-drawing dies.

Prices

Natural and synthetic industrial diamonds differ significantly in price (Boucher, 1997). Natural industrial diamond normally has a more limited range of values. Its price varies from about $0.30 per carat for bort-size material to about $7 to $25 per carat for most stone. Synthetic industrial diamond has a much larger range of prices than natural diamond. Prices of synthetic diamond vary according to size, shape, crystallinity, and the absence or presence of metal coatings. In general, synthetic diamond prices for grinding and polishing range from as low as $0.09 to $1.00 per carat. Strong and blocky material for sawing and drilling sells for $1.50 to $4.00 per carat. Large, synthetic crystals with excellent structure for specific applications sell for several hundred dollars a carat.

In May 1999, DOD sold all stocks of bort that remained in the NDS. The awarded bids ranged from $4.71 to $12.36 per carat, and the average of awarded bids was $5.36 per carat. Also in 1999, NDS sold all the stocks of diamond dies (both mounted and unmounted) in two sales. The average awarded bid for the diamond die sales was $5.83 per die. The NDS diamond stone sales held in 1999 had awarded bids that ranged from $1.03 to $121.57 per carat, with the average awarded bid being $34.49 per carat (Tom Meeker, Defense Logistics Agency, oral commun., 2000).

Foreign Trade

The United States continued to lead the world in industrial diamond trade during 1999; imports came from 49 countries (tables 1 and 2), and exports/reexports went to 53 countries (tables 3 and 4). Although the United States has been a major producer of synthetic diamond for decades, its growing domestic markets have become more reliant on foreign sources of industrial diamond in recent years. U.S. markets for natural industrial diamond always have been dependent on imports and secondary recovery operations because domestic production of natural diamond was unable to meet demand.

During 1999, U.S. imports of industrial quality diamond stones (natural and synthetic) were 3.1 million carats valued at $14.3 million (table 1). Imports of diamond powder, dust, and grit (natural and synthetic) reached 208 million carats valued at $92.3 million (table 2).

During 1999, the United States exported and reexported about 4 million carats of industrial diamond stone valued at $36.7 million (table 3). Additionally, the United States exported and reexported 101 million carats of industrial diamond powder, dust, and grit valued at $68.1 million (table 4). Reexports can account for a significant portion of total exports/reexports; therefore, exports and reexports are listed separately in tables 3 and 4 so that U.S. trade and consumption can be calculated more accurately.

World Review

Total 1999 industrial diamond output worldwide during the year was estimated to be well above 570 million carats; various reports estimate that global output was at least 600 million carats valued between $600 and $900 million (Wilson Born, National Research Company, oral commun., 2000; Norman Rohr, Warren Diamond Powder Co., Inc., oral commun., 1999). World demand for industrial diamond in the 1990's had been growing at annual rates of more than 10% (Boucher, 1997).

More than 30 countries produced industrial diamond in 1999 (tables 5 and 6). In addition to the countries listed in table 6, Germany and the Republic of Korea produce synthetic diamond, but specific data on their output could not be confirmed. China may produce much more than the output shown in the table (Wilson Born, National Research Company, oral commun., 2000; Norman Rohr, Warren Diamond Powder Co., Inc., oral commun., 1999). Nearly 65% of the global industrial diamond output was produced in Ireland, Russia, and the United States. The dominance of synthetic diamond was even more pronounced, accounting for more than 80% of global production and consumption.

Outlook

The United States will continue to be the world's largest market for industrial diamond well into the next decade, and it will remain a significant producer and exporter of industrial diamond.

The strength of U.S. demand will depend on the vitality of the Nation's industrial base and on how well the life cycle cost-effectiveness of diamond compares with competing materials that initially are less expensive. The many advantages that diamond offers for precision machining and longer tool life, which compensate for increases in other production line costs, seem certain to spur demand for diamond tools. In fact, even the use of wear-resistant diamond coatings to increase the life of materials that compete with diamond promises to be a rapidly growing application (May, 1995). Increased tool life not only leads to lower costs per unit of output, but also means fewer tool changes and longer unattended production runs. In view of the many advantages that come from increased tool life, and reports that diamond film surfaces can increase durability by a factor of 50 (Advanced Materials & Processes, 1998), much wider use of diamond as an engineering material is expected.

The most dramatic increase in U.S. demand for industrial diamond is likely to occur in the construction sector as the $200 billion Transportation Equity Act for the 21st Century (Public Law 105-178; enacted June 9, 1998) is further implemented. The Act provides funding for building and repair of the Nation's highway system through 2003. Demand for saw-grade diamond alone is expected to increase by more than $1 billion during the coming year to fulfill goals mandated by the Act for the repair and replacement of roads, bridges, and other components in the transportation infrastructure of the country (Wilson Born, National Research Company, oral commun., 2000).

According to industry sources, PCD for abrasive tools and wear parts will continue to replace competing materials in many industrial applications by providing closer tolerances, as well as extending tool life. For example, PDC and PDS will continue to displace natural diamond stone and tungsten carbide products used in the drilling and tooling industries (Wilson Born, National Research Company, written commun., 1998).

Truing and dressing applications will remain a major domestic enduse for natural industrial diamond stone. The stone cannot be manufactured commercially. No shortage of the stone is anticipated, however, because new mines and more producers selling in the rough diamond market will maintain ample supplies. More competition introduced by the additional sources also may temper price increases.

World demand for industrial diamond will continue to increase during the next few years. Constant-dollar prices of synthetic diamond products will decline as production technologies become more cost-effective and competition increases from low-cost producers in China and Russia.

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[1] Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
U.S. IMPORTS FOR CONSUMPTION OF INDUSTRIAL DIAMOND STONES, BY COUNTRY 1/

(Thousand carats and thousand dollars)

	Natural industrial diamond stones (including glazers' and engravers' diamond unset; HTS 7102.21.3000 and .4000) 2/				Miners' diamond, natural and synthetic (HTS 7102.21.1010 and .1020) 2/			
	1998		1999		1998		1999	
Country	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/
Belgium	175	978	144	2,980	63	427	53	846
China	30	38	2	14	365	52	1	13
Congo (Kinshasa)	15	188	25	30	3	182	--	--
Ghana	252	1,540	159	672	41	416	49	772
India	23	55	4	27	2	201	--	--
Ireland	685	2,130	203	594	35	209	1	23
Japan	1	38	--	--	--	--	--	--
South Africa	2	4	36	51	(4/)	744	(4/)	10
Switzerland	(4/)	34	3	48	575	1,240	676	1,170
United Kingdom	445	1,090	398	517	200	4,330	215	4,900
Other	942	3,310	835	1,300	862	1,250	328	343
Total	2,570	9,410	1,810	6,230	2,150	9,050	1,320	8,090

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Source: Harmonized Tariff Schedule of the United States.
3/ Customs value.
4/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 2
U.S. IMPORTS FOR CONSUMPTION OF DIAMOND POWDER, DUST AND GRIT, BY COUNTRY 1/

(Thousand carats and thousand dollars)

	Synthetic (HTS 7105.10.0020; .0030 and .0050) 2/				Natural (HTS 7105.10.0011 and .0015) 2/			
	1998		1999		1998		1999	
Country	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/
Belgium	4,600	5,120	2,130	1,580	2,700	2,340	4,500	3,730
China	38,700	6,480	33,500	6,040	350	173	227	173
France	223	205	--	--	27	23	--	--
Germany	8	16	75	58	75	59	78	81
Ghana	95	65	87	53	192	198	257	194
Hong Kong	807	562	217	121	--	--	--	--
India	2,050	711	1,820	519	1,070	375	1,350	393
Ireland	100,000	57,300	97,000	56,400	1,770	865	2,250	1,670
Japan	5,760	3,080	4,420	2,800	5	15	401	588
Korea, Republic of	8,990	6,310	9,860	6,460	1,360	723	11	6
Russia	6,540	2,140	5,220	1,180	18	23	23	4
Switzerland	3,510	1,830	3,570	3,020	1,370	874	1,520	1,090
United Kingdom	4,540	1,790	2,070	950	1,190	538	1,440	412
Other	34,600	4,430	34,300	4,450	625	232	2,230	293
Total	210,000	90,000	194,000	83,700	10,700	6,430	14,300	8,630

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Source: Harmonized Tariff Schedule of the United States.
3/ Customs value.

Source: U.S. Census Bureau.

TABLE 3
U.S. EXPORTS AND REEXPORTS OF INDUSTRIAL DIAMOND STONES, BY COUNTRY 1/

(Thousand carats and thousand dollars)

Country	Industrial unworked diamonds (HTS 7102.21.0000) 2/			
	1998		1999	
	Quantity	Value 3/	Quantity	Value 3/
Exports:				
Belgium	46	218	17	141
Canada	187	484	117	410
Germany	206	930	79	473
Hong Kong	2	24	5	41
Ireland	27	235	7	47
Israel	4	54	--	--
Italy	4	39	--	--
Japan	179	1,810	351	3,480
Korea, Republic of	32	319	80	713
Netherlands	7	70	1	12
Switzerland	3	30	12	118
United Kingdom	109	176	16	157
Other	43	380	61	491
Total	849	4,760	746	6,080
Reexports:				
Belgium	3,010	23,000	2,700	25,400
Canada	79	366	64	278
Germany	17	140	15	150
Hong Kong	56	559	12	123
Ireland	10	85	10	99
Israel	189	1,890	129	1,630
Japan	291	2,810	110	1,150
Korea, Republic of	67	675	92	833
Netherlands	--	--	4	43
Switzerland	7	69	1	7
United Kingdom	27	282	27	257
Other	6	74	57	580
Total	3,760	30,000	3,220	30,600
Grand total	4,610	34,700	3,970	36,700

-- Zero.

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

2/ Source: Harmonized Tariff Schedule of the United States.

3/ Customs value.

Source: Bureau of the Census.

TABLE 4
U.S. EXPORTS AND REEXPORTS OF INDUSTRIAL DIAMOND POWDER, DUST AND GRIT, BY COUNTRY 1/

(Thousand carats and thousand dollars)

	Synthetic (HTS 7105.10.0025) 2/				Natural (HTS 7105.10.0010) 2/			
	1998		1999		1998		1999	
Country	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/	Quantity	Value 3/
Exports:								
Australia	469	952	50	53	6	13	--	--
Austria	2,630	1,250	2,670	1,480	214	221	312	138
Belgium	4,370	4,350	1,430	827	994	497	237	157
Brazil	814	396	1,890	1,010	18	93	--	--
Canada	1,610	1,740	1,370	1,420	82	185	89	180
China	1,580	1,700	185	59	24	6	183	31
France	185	109	153	57	22	41	51	114
Germany	4,460	2,780	4,790	2,530	157	104	199	104
Hong Kong	2,280	2,250	482	395	8	15	147	52
India	5,800	1,930	3,230	1,180	413	308	104	56
Ireland	33,500	38,000	27,400	25,400	55	100	258	69
Israel	610	175	481	192	--	--	142	29
Italy	1,900	902	1,860	842	113	76	188	108
Japan	19,100	13,700	19,100	10,800	368	485	414	590
Korea, Republic of	9,030	5,320	12,100	5,920	219	302	969	445
Luxembourg	91	41	35	13	--	--	119	79
Macao	--	--	30	17	141	129	22	7
Malaysia	356	154	447	173	47	22	--	--
Mexico	682	539	1,020	840	43	46	66	73
Singapore	1,930	801	1,210	287	189	91	3	10
Switzerland	2,760	1,820	1,920	1,230	682	366	787	1,190
Taiwan	2,020	2,270	5,840	2,930	16	9	355	95
Thailand	359	294	368	210	128	95	24	23
United Kingdom	1,850	598	2,250	1,460	1,160	1,020	2,110	1,500
Other	768	501	1,180	693	223	122	137	125
Total	99,100	82,600	91,500	60,000	5,320	4,340	6,920	5,180
Reexports:								
Belgium	--	--	189	255	--	--	2	7
Brazil	704	313	--	--	4	3	--	--
Canada	426	797	361	755	23	31	50	101
China	1,500	240	23	29	--	--	--	--
Germany	17	13	--	--	--	--	--	--
Hong Kong	44	12	337	347	27	7	--	--
India	--	--	--	--	--	--	1,350	1,190
Ireland	387	278	2	9	--	--	--	--
Japan	55	20	212	114	26	30	--	--
Korea, Republic of	24	10	25	18	--	--	--	--
Macao	53	67	--	--	--	--	--	--
Malaysia	52	12	121	27	--	--	--	--
Mexico	29	29	23	47	--	--	1	5
Netherlands Antilles	27	34	--	--	--	--	--	--
Singapore	23	10	--	--	--	--	--	--
Switzerland	--	--	3	4	--	--	--	--
Thailand	2	6	16	9	2	4	4	13
United Kingdom	77	18	88	24	--	--	9	11
Total	3,420	1,860	1,400	1,640	83	74	1,410	1,320
Grand total	103,000	84,500	92,900	61,600	5,410	4,420	8,330	6,500

-- Zero.

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

2/ Source: Harmonized Tariff Schedule of the United States.

3/ Customs value.

Source: U.S. Census Bureau.

TABLE 5
NATURAL DIAMOND: ESTIMATED WORLD PRODUCTION, BY TYPE AND COUNTRY 1/ 2/

(Thousand carats)

Country	1995	1996	1997	1998	1999
Gemstones: 3/					
Angola	2,600	2,250	1,110	2,400	1,080
Australia	18,300	18,897 4/	18,100	18,400	13,403 4/
Botswana	11,500	12,400	15,100	14,800 r/	15,000
Brazil	676 4/	200	300	300	300
Canada	--	--	--	300 r/	2,000 p/
Central African Republic	400	350	400	330	400
China	230	230	230	230	230
Congo (Kinshasa)	4,000	3,600	3,000 r/	3,300 r/	3,500
Cote d' Ivoire	53	202	207	210 r/	210
Ghana	126	142	664	649 r/	649
Guinea	274	165	165	300 r/	300
Liberia	60	60	80 r/	150 r/	600
Namibia	1,382 4/	1,402 r/ 4/	1,345 r/	1,394 r/	1,995
Russia	10,500	10,500	10,500	11,500 r/	11,500
Sierra Leone	113	162 4/	300 r/	200 r/	225
South Africa	5,070	4,400 r/	4,500 r/	4,300 r/	4,000
Venezuela	125	99	158	100	100
Zimbabwe	114	300	321	10 r/	--
Other	119	165	123 r/	106 r/	107
Total	55,700	55,500 r/	56,600	58,900 r/	55,600
Industrial:					
Angola	300	250	124	364	120
Australia	22,400	23,096 4/	22,100	22,500	16,381 4/
Botswana	5,300	5,000	5,000	5,000	5,000
Brazil	600	600	600	600	600
Central African Republic	130	120	100	200	150
China	900	900	900	900	920
Congo (Kinshasa)	13,000	17,000	17,600 r/	18,900 r/	14,500
Cote d' Ivoire	22	100	100	100	100
Ghana	505	573	166	160	160
Guinea	91	40	40	100 r/	100
Liberia	90	90	120 r/	150 r/	400
Namibia	--	--	71	73	105
Russia	10,500	10,500	10,500	11,500 r/	11,500
Sierra Leone	101	108	100 r/	50 r/	75
South Africa	5,880	5,550 r/	5,540 r/	6,460 r/	6,000
Venezuela	66	73	90	150	150
Zimbabwe	90	137	100	19 r/	--
Other	101	120	105	97 r/	68
Total	60,100	64,300 r/	63,400 r/	67,300 r/	56,300
Grand total	116,000	120,000	120,000 r/	126,000 r/	112,000

p/ Preliminary. r/ Revised. -- Zero.

1/ World 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 May 26, 2000.

3/ Includes near- and cheap-gem qualities.

4/ Reported figure.

TABLE 6
SYNTHETIC DIAMOND: ESTIMATED WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Thousand carats)

Country	1995	1996	1997	1998	1999
Belarus	25,000 4/	25,000	25,000	25,000	25,000
China	15,500	15,500	16,000	16,500	16,500
Czech Republic	5,000	5,000	5,000	5,000	3,000
France	3,000	3,000	3,500	3,000	3,000
Greece	1,000	750	750	750	750
Ireland	60,000	60,000	60,000	60,000	60,000
Japan	32,000	32,000	32,000	32,000	32,000
Poland	256 4/	250 4/	260	210	200
Romania	5,000	5,000	5,000	3,000	3,000
Russia	80,000	80,000	80,000	80,000	80,000
Slovakia	5,000	5,000	5,000	5,000	3,000
South Africa	60,000	60,000	60,000	60,000	--
Sweden	25,000	25,000	25,000	25,000	25,000
Ukraine	8,000	8,000	8,000	8,000	8,000
United States	115,000	114,000	125,000	140,000	208,000
Total	440,000	439,000	451,000	463,000	467,000

-- Zero.

1/ World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through May 26, 2000.

3/ In addition to the countries listed, the Republic of Korea also produced significant amounts of synthetic diamond, but output was not officially reported, and available information is inadequate to formulate reliable estimates of output levels.

4/ Reported figure.