2014 Minerals Yearbook

DIAMOND, INDUSTRIAL [ADVANCE RELEASE]

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Diamond, Industrial

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In 2014, U.S. synthetic diamond production was estimated to be 124 million carats with an estimated value of $84.2 million. U.S. imports of natural and synthetic industrial diamond bort, dust, grit, powder, and stone totaled 684 million carats valued at $108 million, and exports totaled 163 million carats valued at $80.5 million. The estimated U.S. apparent consumption of industrial diamond bort, dust, grit, powder, and stone totaled 690 million carats with an estimated value of $134 million. Total industrial diamond output worldwide was estimated by the U.S. Geological Survey (USGS) to be 4.46 billion carats valued at between $1.65 billion and $2.50 billion. This was the combination of more than 52.8 million carats of natural industrial diamond and about 4.41 billion carats of synthetic industrial diamond (table 1).

Diamond is best known as a gemstone, but some of its unique properties make it ideal for many industrial and research applications. Current information on gem-grade diamond can be found in the USGS Minerals Yearbook, volume I, Metals and Minerals, chapter on gemstones. Diamond that does not meet gem-quality standards for clarity, color, shape, or size is used as industrial-grade diamond. Total production and apparent consumption quantities and values in table 1 are estimated based on past and current reported data. Trade data in this report are from the U.S. Census Bureau. All percentages in the report were calculated using unrounded data.

Production

The USGS conducts an annual survey of domestic synthetic industrial diamond producers and a survey of U.S. firms that recover diamond wastes. Production quantities and values for the nonreporting companies were estimated based on industry production trends, reports from some producers and other industry sources, and discussions with consultants within the industrial diamond industry. The USGS does not conduct surveys of domestic producers of polycrystalline diamond (PCD) or chemical vapor deposition (CVD) diamond for quantity or value of annual production.

During 2014, the United States was the world's second-ranked producer of synthetic industrial diamond after China, which led the world in synthetic industrial diamond production. The United States accounted for an estimated output of 124 million carats valued at more than $84 million. This was a 15% increase in both quantity and value compared with those of the previous year. Only two U.S. companies produced synthetic industrial diamond during the year—Sandvik Hyperion (Worthington, OH) and Microdiamant USA, Inc. (Smithfield, PA). Sandvik Hyperion was created during 2014 through the merger of Sandvik Hard Materials and Diamond Innovations, Inc. Microdiamant USA, Inc. was renamed from Mypodiamond Inc. during 2014.

In 2014, at least eight U.S. companies also manufactured PCD from synthetic diamond grit and powder. These companies were Dennis Tool Co. (Houston, TX), Novatek Inc. (Provo, UT), Precorp Inc. (Provo), Sandvik Hyperion, Sii MegaDiamond Inc. (Provo), Tempo Technology Corp. (Somerset, NJ), US Synthetic Corp. (Orem, UT), and Western Diamond Products LLC (Salt Lake City, UT).

During 2014, an estimated 44.3 million carats of used industrial diamond (natural and synthetic) worth about $22.5 million (table 1) was recycled (secondary production) in the United States. This was a 15% increase in quantity and a 16% increase in value compared with those of the previous year. Recycling firms recovered most of this material from used diamond drill bits, diamond tools, and other diamond-containing wastes. Additional diamond was recovered during the year from residues generated in the manufacture of PCD.

The recovery and sale of industrial diamond was the principal business of three U.S. companies in 2014—Industrial Diamond Laboratory, Inc. (Bronx, NY), International Diamond Services Inc. (Houston, TX), and National Research Co. (Fraser, MI). In addition to these companies, other domestic firms may have recovered industrial diamond in smaller secondary operations.

Since the 1950s, when scientists manufactured the first synthetic bits of diamond grit using a high-pressure, high-temperature (HPHT) method, this method of growing diamonds has become relatively commonplace in the world as a technology for synthetic diamond production. Diamonds of 1 carat or more are harder to manufacture because, at that size, it is difficult to consistently produce diamonds of high quality, even in the controlled environment of a laboratory using the HPHT method. After more than 50 years of development, several synthetic diamond companies were able to produce relatively large high-quality industrial diamonds that equaled those produced from mines.

In the early 2000s, technology was developed for a method for growing single, extremely pure diamond crystals by CVD. The CVD technique transforms carbon into plasma, which is then precipitated onto a substrate as diamond. CVD had been used for more than a decade to cover large surfaces with microscopic diamond crystals, but in developing this process, synthetic diamond producers discovered the temperature, gas composition, and pressure combination that resulted in the growth of a single diamond crystal and were able to produce synthetic stones that ranged from 1 to 2 carats.

During 2014, Scio Diamond Technology Corp. (Greenville, SC) used CVD technology to produce synthetic single-crystal diamond stones that ranged from 3 to 5 carats for finishing into 1- to 2-carat diamond stones and polishing for jewelry or sliced and shaped for industrial applications. Scio Diamond prefers to call their diamonds "cultured" rather than synthetic, referring to the fact that the diamonds are grown much like a cultured pearl is grown. Scio Diamond reported that for the fiscal year ending March 31, 2015, they had manufactured more than 39,300 carats of rough diamond. This production was a 71% increase over the previous fiscal year's production (Scio Diamond Technology Corp., 2014, 2015a, b).

No commercial diamond mines operated in the United States during 2014. The last commercially operated diamond mine in the United States closed in 2002 and was fully reclaimed.

Consumption

Diamond is the hardest known material and has the highest thermal conductivity of any material at room temperature. Diamond is more than twice as hard as its nearest competitors, cubic boron nitride and silicon nitride. Because of its hardness, diamond has been used for centuries as an abrasive in cutting, drilling, grinding, and polishing. Industrial-grade diamond continues to be used as an abrasive for many applications. Even though it has a higher unit cost than alternative abrasive materials, diamond has proven to be more cost effective in many industrial processes because it cuts faster and lasts longer than alternatives. 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, computing, and other advanced technologies.

Both natural and synthetic diamonds have industrial uses. Synthetic industrial diamond is superior to its natural diamond counterpart because its properties can be tailored to specific applications, and it can be produced in large quantities.

The United States remained the world's leading market for industrial diamond in 2014. Based on production estimates and trade data, U.S. apparent consumption of industrial diamond during the year decreased by 5% in quantity to an estimated 690 million carats and increased by 7% in value to $134 million compared with 728 million carats valued at $125 million in 2013 (table 1).

The major consuming industrial sectors of industrial diamond cutting and drilling tools and abrasives in the United States during 2014 were construction, machinery manufacturing, mining services (exploration drilling for minerals, natural gas, and oil), stone cutting and polishing, and transportation systems (infrastructure and vehicles). Within these sectors, highway building and repair and stone cutting, combined, accounted for the majority of consumption of industrial diamond. 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, polishing of silicon wafers and disk drives, and other applications in the computer industry.

Diamond tools have numerous industrial functions. Diamond drilling bits and reaming shells are used principally for extraction of minerals, natural gas, and oil. Other applications of diamond bits and reaming shells include foundation testing, inspecting concrete, and masonry drilling. The primary uses of point diamond tools are for dressing and truing grinding wheels and for boring, cutting, finishing, and machining applications. Beveling glass for automobile windows is another application. Cutting dimension stone and cutting and grooving concrete in highway reconditioning are the main uses of diamond saws; other applications include cutting composites and forming 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 carbide machine tool tips.

Two types of natural diamond are used by industry—diamond stone (generally larger than 60 mesh, 250 micrometers) and diamond bort, dust, grit, and powder (smaller, fragmented material). Diamond stone is used mainly in drill 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 used for drill bits and as a loose grain abrasive for polishing. Other tools that incorporate natural diamond include bearings, engraving points, glass cutters, and surgical instruments.

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

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

Consumption quantity and value data are not available for PCD or for CVD diamond. Two types of PCDs used by industry are polycrystalline diamond compacts (PDCs) and polycrystalline diamond shapes (PDSs). The use of PDCs and PDSs continues to increase for many of the applications cited above, including some of those that employ natural diamond. PDCs and PDSs are used in the manufacture of single- and multiple-point tools, and PDCs are used in a majority of the diamond wire-drawing dies.

Since its introduction in the mid-1980s, CVD diamond has seen strong growth and has been increasingly accepted by multiple industries as an enhanced material of choice owing to its properties of exceptional strength, durability, stiffness, high thermal conductivity, and electrical isolation.

Early applications for CVD diamond focused largely around thin- and thick-film PCD for cutting tools and dressing applications because of the mechanical properties of diamond. Newer applications that take advantage of CVD diamond's mechanical properties include wear parts, such as watch gears and chemical mechanical polishing pad conditioners. Diamond has tremendous potential for electronics applications because it significantly improves upon current strategies for thermal management while remaining highly cost competitive with other approaches. CVD diamond is used in microelectronic components, such as high-speed processors, medical devices, wide bandgap radio frequency (RF) devices, power conversion devices, and opto-electronic devices (light-emitting diodes, laser diodes) that generate exceptionally high heat densities requiring innovative approaches to thermal management. Diamond coatings are increasingly being used in these applications because the thermal conductivity of diamond is 10 times that of silicon. In the manufacture of semiconductors, wafer-scale diamond offers enhanced mechanical properties, such as significantly higher stiffness, strength, hardness, thermal conductivity, and chemical inertness, compared with silicon and most other commonly used thin-film materials. Micro-electro-mechanical systems (MEMS), such as RF MEMS resonators, have design needs that can be met by the use of diamond as a base material because of its very high resistance to being deformed elastically when a force is applied and because of its durability in harsh environments. Researchers are investigating the use of boron-doped diamond (BDD) electrodes for water treatment owing to diamond's potential as an environmentally friendly, high-performance electrode material. BDD electrodes have many characteristics that make them ideal for eliminating organic contaminants from water (Zimmer, 2011).

Historically, diamond has been perceived as an expensive material. Advances in CVD diamond manufacturing, such as the development of microwave carbon plasma technology and the development of higher throughput hot filament CVD diamond reactors, have significantly reduced diamond costs. This led many industries to revisit development activities and actively pursue the use of CVD diamond for an increasing number of applications (Zimmer, 2011).

In addition to the existing opportunities for their cultured diamond gemstones, Scio Diamond was developing the use of single-crystal CVD diamond materials in high-voltage power switches, lasers, quantum communications and computing, and water treatment and purification. Scio Diamond reported that these projects could translate into high-value market opportunities and high-volume technology applications (Scio Diamond Technology Corp., 2012).

Prices

Natural and synthetic industrial diamonds differ significantly in price. Natural industrial diamond normally had a more limited range of values, from about $0.50 per carat for bort-size material to about $2.50 to $10 per carat for most stones, with some larger stones having sold for several hundred dollars per carat. Prices of synthetic diamond vary according to size, shape, crystallinity, and the absence or presence of metal coatings. In general, prices for synthetic diamond for grinding and polishing ranged from as low as $0.26 per carat to $2.65 per carat. Strong and blocky material for sawing and drilling sold for $2.35 to $4.00 per carat. Large, synthetic crystals with excellent structure for specific applications sold for several hundred dollars per carat. During 2014, U.S. imports of all types of industrial diamond had an average value of $0.16 per carat. These imports were a combination of diamond bort, dust, grit, and powder (natural and synthetic) that had an average value of $0.11 per carat and diamond stone (natural and synthetic) that had an average value of $14.44 per carat. These average unit values for imported diamond bort, dust, grit, and powder (natural and synthetic) were lower than the average reported prices for the same size fractions of domestically produced diamond listed above.

Foreign Trade

The United States continued to lead the world in industrial diamond trade in 2014; imports were received from 34 countries and exports and reexports were sent to 43 countries (tables 2–5). Although the United States has been a major producer of synthetic diamond for decades, expanding domestic markets have become more reliant on foreign sources of industrial diamond in recent years. U.S. markets for natural industrial diamond have always been dependent on imports and secondary recovery operations because natural diamond has not been produced domestically.

During 2014, U.S. imports of industrial-quality diamond stones (natural and synthetic) increased by 11% from those of 2013 to 2.16 million carats valued at $31.2 million (table 2). Imports of diamond bort, dust, grit, and powder (natural and synthetic) decreased by 6% from those of 2013 to 682 million carats valued at $76.7 million (table 3).

Reexports accounted for a significant portion of total exports; therefore, exports and reexports are listed separately in tables 4 and 5 so that U.S. trade and consumption can be calculated more accurately. During 2014, the United States did not export industrial diamond stones, unchanged from 2013. U.S. reexports of industrial diamond stone increased by 12% from those of 2013 to 826,000 carats valued at $23.3 million and an average value of $28.26 per carat (table 4). U.S. exports of industrial diamond bort, dust, grit, and powder (natural and synthetic) increased by 9% from those of 2013 to 163 million carats valued at $80.5 million and an average value of $0.50 per carat. Reexports of industrial diamond bort, dust, grit, and powder (natural and synthetic) decreased by 13% from those of 2013 to 12.9 million carats valued at $5.99 million and an average value of $0.46 per carat (table 5). Trade quantity and value data are not available for PCD or for CVD diamond.

World Industry Structure

Global natural diamond production decreased by 4% during 2014 to 125 million carats from 130 million carats in 2013. The world's leading rough diamond producers, in decreasing order of quantity produced, were as follows: Russia, producing 38.3 million carats, or 31% of total world production; Botswana, with 24.7 million carats (20%); Congo (Kinshasa), with 15.7 million carats (13%); Canada, with 12.0 million carats (10%); Australia, with 9.29 million carats (7%); Angola, with 8.79 million carats (7%); South Africa, with 7.43 million carats (6%); Zimbabwe, with 4.77 million carats (4%); and other countries, with 3.86 million carats (3%) (table 6). Of the 125 million carats of total natural diamond production, 72 million carats (58% of total diamond production) was gemstone diamond and 52.8 million carats (42% of total diamond production) was industrial diamond. Total combined natural and synthetic industrial diamond output worldwide was estimated by the USGS to be about 4.46 billion carats (table 1). In 2014, rough diamond production was valued at more than $19 billion, an increase of almost 6% compared with that of 2013 (De Beers Group Inc., 2015, p. 18).

During 2014, ALROSA Group and De Beers Group Inc. remained the two leading diamond producers by quantity and value. ALROSA's production was 29% of total global quantity and 29% of total global value; De Beers' production was 26% of total global quantity and 38% of total global value. The third-ranked company was Rio Tinto Ltd., which produced 13% of total global production quantity and approximately 5% of global production value (Diamond Shades, 2017).

In 2002, the international rough-diamond certification system, the Kimberley Process Certification Scheme (KPCS), was agreed upon by United Nations (UN) member nations, the diamond industry, and involved nongovernmental organizations to prevent the shipment and sale of conflict diamonds. Conflict diamonds are diamonds that originate from areas controlled by forces or factions opposed to legitimate and internationally recognized Governments and are used to fund military action in opposition to those Governments or in contravention of the objectives of the UN Security Council. The KPCS monitors rough-diamond trade in both gemstone and industrial diamond. The KPCS includes the following key elements: the use of forgery-resistant certificates and tamper-proof containers for shipments of rough diamonds; internal controls and procedures that provide credible assurance that conflict diamonds do not enter the legitimate diamond market; a certification process for all exports of rough diamonds; the gathering, organizing, and sharing of import and export data on rough diamonds with other participants of relevant production; credible monitoring and oversight of the international certification scheme for rough diamonds; effective enforcement of the provisions of the certification scheme through dissuasive and proportional penalties for violations; self-regulation by the diamond industry that fulfills minimum requirements; and sharing information with all other participants on relevant rules, procedures, and legislation as well as examples of national certificates used to accompany shipments of rough diamonds. China assumed the chair of KPCS from January 1 through December 31, 2014. As of December 31, 2014, the 54 participants represented 81 nations (including the 28 member nations of the European Union counted as a single participant) plus the rough-diamond-trading entity of Taipei (Taiwan). During 2014, the Central African Republic was under a temporary suspension of exports and imports of rough diamonds and Venezuela voluntarily suspended exports and imports of rough diamonds until further notice. The participating nations in the KPCS account for approximately 99.8% of the global production and trade of rough diamonds (Kimberley Process, undated).

In 2014, natural industrial diamond production was reported from 12 countries (table 6). Natural industrial diamond production worldwide was estimated to be about 52.8 million carats, a 12% decrease compared with 59.9 million carats in 2013. Russia was the leading natural-industrial-diamond-producing country with 16.9 million carats or 32% of total world production; followed by Congo (Kinshasa), with 12.5 million carats (24%); Australia, with 9.10 million carats (17%); Botswana, with 7.40 million carats (14%); and Zimbabwe, with 4.29 million carats (8%). These five countries produced 95% of the world's natural industrial diamond (table 6). Synthetic industrial diamond production worldwide was estimated to be more than 4.41 billion carats, a slight increase compared with that of 2013. China was the leading producing country, followed by the United States, Russia, Ireland, and South Africa, in descending order of quantity. These five countries produced about 98% of the world's synthetic industrial diamond.

In 2014, 97% of the total global combined output of natural and synthetic industrial diamond was produced in China, Ireland, Russia, South Africa, and the United States. Synthetic diamond accounted for more than 98% of global diamond production and consumption.

Worldwide diamond exploration spending decreased by 9% in 2014 with 48 companies allocating $447 million, compared with 47 companies allocating $489 million during 2013. The diamond share of overall worldwide mineral exploration spending was 4.2% (SNL Metals Economics Group, 2014a, p. 20).

In 2014, worldwide average diamond values increased by 5% to $135.77 per carat from the 2013 average value of $128.82 per carat (Diamond Shades, 2017).

Three new diamond mines started production in 2014; they were the Grib Mine and the Karpinskogo-1 Mine in western Russia and the Ghaghoo Mine in Botswana (De Beers Group Inc., 2015, p. 20).

World Review

Botswana.—Diamond production in Botswana was 24.7 million carats during 2014, a 6% increase compared with that of 2013, accounting for 20% of the world's combined natural gemstone and industrial diamond output.

The Ghaghoo Mine in Botswana began production during the second half of 2014. The mine was operated by Gem Diamonds Ltd. and was the first underground mine in Botswana. At full production, Ghaghoo was expected to produce 750,000 carats per year (De Beers Group Inc., 2015, p. 20; Zimnisky, 2014).

Canada.—Diamond production in Canada was 12.0 million carats during 2014, a 14% increase compared with that of 2013, accounting for 10% of the world's combined natural gemstone and industrial diamond output. Diamond exploration continued in Canada, with several commercial diamond projects and additional discoveries in Alberta, British Columbia, the Northwest Territories, Nunavut, Ontario, and Quebec.

One of the world's most anticipated diamond development projects was the Gahcho Kué diamond mine, 280 kilometers northeast of Yellowknife, Northwest Territories. Gahcho Kué continued moving forward with permitting approval in the second half of 2014, and mechanical completion of the processing plant and cold commissioning expected to start in 2015. At full production, Gahcho Kué production was expected to be 5 million carats of diamonds per year, with an estimated 15-year mine life. Ownership of the Gahcho Kué Mine was De Beers Canada, 51%, and Mountain Province Diamonds, 49% (Zimnisky, 2014).

Russia.—Diamond production in Russia was 38.3 million carats during 2014, a slight increase compared with that of 2013, accounting for 31% of total global production.

The Grib Mine in the Arkhangelsk Region of western Russia was wholly owned by OAO LUKOIL and had its first full year of production in 2014. The mine started production as an open pit that was expected to produce about 58 million carats during its projected 19-year mine life and after transition to an underground mine was expected to produce an additional

40 million carats. Production was expected to be 3 to 4 million carats per year. Initial development of the open pit mine was projected to cost $850 million; no capital cost estimate for the underground mine was available. The Grib Mine had reserves containing 98.5 million carats (SNL Metals Economics Group, 2014b, p. 8; Zimnisky, 2014).

The Karpinskogo-1 Mine, also located in the Arkhangelsk Region of western Russia, was wholly owned and operated by ALROSA. It was estimated that the mine would have a 16-year mine life with production expected to be 2 million carats per year (De Beers Group Inc., 2015, p. 20; Zimnisky, 2014).

Outlook

China is expected to remain the world's leading producer of synthetic industrial diamond, with annual production exceeding 4 billion carats. The United States is likely to continue to be one of the world's leading markets for industrial diamond into the next decade and likely will remain a significant producer and exporter of synthetic industrial diamond as well. U.S. industrial diamond production and apparent consumption are expected to continue increasing as manufacturing sectors that use industrial diamond continue experiencing economic growth. U.S. demand for industrial diamond is likely to continue in the construction sector as the United States continues building and repairing the Nation's highway system.

Diamond offers many advantages for precision machining and longer tool life. In fact, even the use of wear-resistant diamond coatings to increase the life of materials that compete with diamond is a rapidly growing application. Increased tool life not only leads to lower costs per unit of output but also means fewer tool changes and longer production runs. In view of the many advantages that come from increased tool life and reports that diamond film surfaces can increase durability, much wider use of diamond as an engineering material is expected.

CVD diamond is likely to be used to provide a better and more efficient alternative process to existing water purification processes. This technology will use single-crystal diamond electrodes for electrochemical water purification.

Truing and dressing applications will remain a major domestic end use for natural industrial diamond stone. Stones for these applications have not yet been manufactured economically. 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.

Demand for synthetic diamond bort, dust, grit, and powder is expected to remain greater than for natural diamond material. Constant-dollar prices of synthetic diamond products are likely to continue to decline as production technology becomes more cost effective. The decline is even more likely if competition from low-cost producers in China and Russia continues to increase.

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TABLE 1
SALIENT NATURAL AND SYNTHETIC INDUSTRIAL DIAMOND STATISTICS[1]

(Thousand carats and thousand dollars)

	2010	2011	2012	2013	2014
United States:					
Natural:					
Secondary production:[e]					
Quantity	16,700	17,300	18,300	19,000	21,900
Value	8,190	8,470	8,920	9,240	10,600
Exports:					
Quantity	2,330	3,710	6,500	6,420 r	8,990
Value	1,780	1,780	4,100	5,010 r	5,670
Imports for consumption:					
Quantity	6,430 r	9,730 r	6,420 r	6,810 r	5,560
Value	34,400 r	51,700 r	37,300 r	30,400 r	32,500
Synthetic:					
Primary production:[e]					
Quantity	93,000	98,200	103,000	108,000	124,000
Value	66,400	67,100	70,600	73,200	84,200
Secondary production:[e]					
Quantity	17,100	17,700	18,600	19,400	22,400
Value	9,120	9,260	9,750	10,100	11,900
Exports:					
Quantity	110,000	146,000	149,000	143,000 r	154,000
Value	51,000	68,600	73,200	72,600 r	74,900
Imports for consumption:					
Quantity	591,000	721,000	591,000	724,000 r	679,000
Value	84,200 r	94,300 r	78,300 r	79,400 r	75,400
Apparent consumption, natural and synthetic:[e, 2]					
Quantity	612,000 r	714,000 r	582,000 r	728,000 r	690,000
Value	149,000 r	160,000 r	128,000 r	125,000 r	134,000
World, production:[e]					
Natural	58,400	55,600	61,200	59,900	52,800
Synthetic	4,380,000	4,380,000	4,390,000	4,390,000	4,410,000
Natural and synthetic	4,430,000	4,440,000	4,450,000	4,450,000	4,460,000

[e]Estimated. [r]Revised.
[1]Data are rounded to no more than three significant digits.
[2]Domestic primary and secondary production plus imports minus exports.

TABLE 2

U.S. IMPORTS FOR CONSUMPTION OF INDUSTRIAL DIAMOND STONES, BY COUNTRY[1]

(Thousand carats and thousand dollars)

	Natural industrial diamond stones[2]				Miners' diamond, natural and synthetic[3]			
	2013		2014		2013		2014	
Country	Quantity	Value[4]	Quantity	Value[4]	Quantity	Value[4]	Quantity	Value[4]
Australia	91	1,260	83	784	--	--	(5)	24
Belgium	12	208	(5)	2	(5)	35	--	--
Botswana	323	14,800	433	18,800	--	--	2	33
Congo (Kinshasa)	7	57	20	556	(5)	19	--	--
Ghana	(5)	2	4	148	--	--	--	--
India	512	596	659	743	21	121	(5)	34
Namibia	157	1,530	80	517	(5)	7	--	--
Russia	16	342	6	278	--	--	--	--
South Africa	747	9,180	846	8,860	5	242	25	49
Other	42 r	335 r	4	62	7 r	1,280	3	269
Total	1,910	28,300	2,130	30,800	33 r	1,710	30	409

rRevised. -- Zero.

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

[2]Includes glazers' and engravers' diamond unset, Harmonized Tariff Schedule of the United States (HTS) codes 7102.21.3000 and 7102.21.4000 for natural industrial diamond stone.

[3]HTS codes 7102.21.1010 and 7102.21.1020 for miners' diamond, natural and synthetic.

[4]Customs value.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 3

U.S. IMPORTS FOR CONSUMPTION OF DIAMOND BORT, DUST, GRIT, AND POWDER, BY COUNTRY[1]

(Thousand carats and thousand dollars)

	Natural[2]				Synthetic[3]			
	2013		2014		2013		2014	
Country	Quantity	Value[4]	Quantity	Value[4]	Quantity	Value[4]	Quantity	Value[4]
Belgium	84	46	12	7	1,200	427	906	237
China	713	166	605	300	592,000 r	40,200 r	549,000	43,900
Germany	194	115	192	114	194	98	130	85
Hong Kong	4	4	--	--	775	118	210	18
India	1,640	679	1,820	715	298	166	2,010	396
Ireland	526	313	285	167	48,700	21,400	38,900	14,700
Israel	--	--	--	--	160	58	128	59
Italy	--	--	--	--	4	19	10	7
Japan	--	--	10	15	885	1,150	1,150	1,420
Korea, Republic of	2	4	--	--	16,500	5,310	19,000	5,670
Mexico	23	25	--	--	--	--	--	--
Romania	--	--	3	5	34,800	2,030	45,300	2,660
Russia	965	244	3	5	14,100	2,570	16,900	3,410
Switzerland	202	120	134	122	9,930	2,670	1,970	1,410
Taiwan	--	--	--	--	470	59	44	42
Ukraine	--	--	--	--	6	4	4	3
United Kingdom	410	256	303	182	2,050	504	1,840	371
Other	145	162	65	50	1,840	898	1,150	633
Total	4,910	2,130	3,430	1,680	724,000 r	77,700 r	679,000	75,000

rRevised. -- 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 codes 7105.10.0011 and 7105.10.0015 for natural diamond.

[3]Harmonized Tariff Schedule of the United States codes 7105.10.0020, 7105.10.0030, and 7105.10.0050 for synthetic diamond.

[4]Customs value.

Source: U.S. Census Bureau.

TABLE 4

U.S. REEXPORTS OF INDUSTRIAL DIAMOND STONES, BY COUNTRY[1]

(Thousand carats and thousand dollars)

	Industrial unworked diamonds[2]			
	2013		2014	
Country	Quantity	Value[3]	Quantity	Value[3]
Belgium	303 r	7,480 r	330	7,510
Brazil	16 r	127 r	16	134
Canada	53 r	587 r	57	706
Germany	5 r	272 r	7	285
Hong Kong	14	624	14	624
Israel	27	162	79	514
Japan	109 r	7,450 r	101	8,290
Korea, Republic of	61 r	1,420 r	64	996
United Kingdom	101 r	2,600 r	84	2,490
Other	50 r	1,730 r	74	1,790
Total	739 r	22,500 r	826	23,300

[r]Revised.

[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 code 7102.21.0000.

[3]Values are free alongside ship.

Source: U.S. Census Bureau.

TABLE 5

U.S. EXPORTS AND REEXPORTS OF INDUSTRIAL DIAMOND BORT, DUST, GRIT, AND POWDER, BY COUNTRY[1, 2]

(Thousand carats and thousand dollars)

	Natural				Synthetic			
	2013		2014		2013		2014	
Country	Quantity	Value[3]	Quantity	Value[3]	Quantity	Value[3]	Quantity	Value[3]
Exports:								
Austria	--	--	22	13	1,430	599	4,170	1,170
Belgium	104 r	221 r	181	336	146 r	36 r	241	72
Brazil	--	--	--	--	3,040 r	986 r	2,680	889
Canada	3,070 r	2,890 r	3,420	2,660	4,130 r	2,570 r	3,450	2,350
Germany	32 r	35 r	21	23	718 r	206 r	1,110	385
Hong Kong	59 r	108	112	202	198	127	162	139
India	--	--	--	--	2,280	827	3,690	1,130
Ireland	52 r	86 r	14	20	24,900 r	9,310 r	11	6
Israel	46	57	191	65	801	323	3,560	1,330
Italy	--	--	--	--	5,270	1,510	4,000	868
Japan	152 r	271 r	177	301	30,600 r	13,900 r	32,900	14,900
Korea, Republic of	1,750 r	359 r	2,270	490	16,600 r	10,000 r	20,200	9,950
Mexico	556 r	439 r	627	589	1,150 r	420 r	1,470	652
Singapore	4 r	11 r	2	6	726 r	2,120 r	2,080	3,640
Spain	--	--	--	--	24	6	64	12
Switzerland	175 r	135 r	402	267	15,700	13,800	12,700	11,800
Taiwan	--	--	--	--	6,440	4,400	6,080	3,850
Thailand	80 r	55 r	53	58	6,660 r	2,150 r	6,000	1,910
United Kingdom	249 r	266 r	1,450	527	1,820 r	717 r	3,090	1,100
Other	94 r	79 r	50	122	19,800 r	8,600 r	46,000	18,700
Total	6,420 r	5,010 r	8,990	5,670	143,000 r	72,600 r	154,000	74,900
Reexports:								
Belgium	49	82 r	97	160	26 r	11	86	39
Brazil	--	--	--	--	435 r	254	294	177
Canada	1,850	1,910 r	2,380	1,900	1,540 r	688 r	929	477
Germany	4	7 r	2	12	19 r	8	39	14
Ireland	10	17 r	6	11	2,040 r	821	--	--
Japan	152	271 r	177	301	5,490 r	1,300	5,780	1,270
Korea, Republic of	15	17 r	16	22	1,200 r	708	800	293
Mexico	16	32 r	15	41	605 r	221	556	176
United Kingdom	70	119 r	51	57	32 r	19	87	39
Other	50 r	85 r	39	87	1,180 r	957 r	1,530	910
Total	2,210	2,540 r	2,780	2,590	12,600 r	4,990 r	10,100	3,400
Grand total	8,630 r	7,550 r	11,800	8,270	155,000 r	77,600 r	164,000	78,300

rRevised. -- 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 codes 7105.10.0010 for natural and 7105.10.0025 for synthetic.

[3]Values are free alongside ship.

Source: U.S. Census Bureau.

TABLE 6

DIAMONDS (NATURAL): WORLD PRODUCTION, BY COUNTRY AND TYPE[1, 2]

(Thousand carats)

Country and type[3]	2010	2011	2012	2013	2014
Gemstones:					
Angola[4]	7,526 r	7,496 r	7,498 r	8,424 r	7,912
Australia[5]	200	157	184	235	186
Botswana[6]	15,413 r	16,033 r	14,388 r	16,231 r	17,268
Brazil, unspecified[7]	25	46	46	49	57
Cameroon, unspecified	--	--	--	3 [8]	4 [8]
Canada, unspecified	11,804 r	10,795 r	10,451 r	10,562 r	12,012
Central African Republic[9, 10]	241	259	293	--	--
China, unspecified	17	(11)	2	1	--
Congo (Brazzaville), unspecified	381	77	52	56	53
Congo (Kinshasa)[12]	4,033 r	3,850 r	4,305 r	3,136 r	3,130
Côte d'Ivoire, unspecified	--	--	--	--	1
Ghana, unspecified	334	302	233	169	242
Guinea[10]	299	243	213	162	131
Guyana	46	51	44	60	100
India[13]	5	3	7	10	10
Lesotho, unspecified	109	224	479	414	346
Liberia[14]	16	25	25	32	39
Namibia, unspecified	1,693 r	1,256 r	1,629 r	1,689 r	1,918
Russia[15]	19,520 r	19,678 r	19,559 r	21,215 r	21,450
Sierra Leone[16]	263	214	433 r	487 r	496
South Africa[10]	7,090 r	5,636 r	5,662 r	6,515 r	5,945
Tanzania[17]	53 r	31 r	95 r	135 r	190
Togo, unspecified	(11)	(11)	(11)	(11)	(11)
Venezuela[18]	1	--	--	--	--
Zimbabwe[19]	844	850	1,206 r	1,041 r	477
Total, gemstones	69,900	67,200	66,800	70,600	72,000
Industrial:					
Angola[4]	836	833	833	936	879
Australia[5]	9,777 r	7,673 r	8,997 r	11,494 r	9,102
Botswana[6]	6,605 r	6,871 r	6,166 r	6,956 r	7,400
Central African Republic[10]	60	65	73	--	--
Congo (Kinshasa)[12]	16,133 r	15,399 r	17,219 r	12,546 r	12,522
Guinea[10]	75	61	53	40	33
India[13]	13	9	20	27	27
Liberia[14]	11	17	17	21	26
Russia[15]	15,337 r	15,462 r	15,368 r	16,669 r	16,854
Sierra Leone[16]	175	143	108 r	122 r	124
South Africa[10]	1,773 r	1,409 r	1,415 r	1,629 r	1,486
Tanzania[17]	18 r	10 r	32 r	45 r	63
Venezuela[18]	1	--	--	--	--
Zimbabwe[19]	7,592 r	7,652 r	10,854 r	9,371 r	4,294
Total, industrial	58,400	55,600	61,200	59,900	52,800
Grand total, unrounded	128,317	122,829	127,962	130,482	124,778

[r]Revised. -- Zero.

[1]Gem and industrial quantities are estimated from reported country totals; may not add to totals shown.

[2]Includes data available through October 2, 2015.

[3]In addition to the countries listed, Belarus and Nigeria produced natural diamond, but information is inadequate to formulate reliable estimates of output levels.

[4]About 90% gem quality and 10% industrial quality.

[5]About 2% gem quality and 98% industrial quality.

[6]About 70% gem and near gem quality and 30% industrial quality.

[7]Figures represent officially reported diamond output plus official Brazilian estimates of output by nonreporting miners.

[8]From artisanal mining.

[9]Includes artisanal mining.

[10]About 80% gem quality and 20% industrial quality.

[11]Less than ½ unit.
[12]About 20% gem quality and 80% industrial quality.
[13]About 27% gem quality and 73% industrial quality.
[14]About 60% gem quality and 40% industrial quality.
[15]About 56% gem quality and 44% industrial quality.
[16]In 2010 and 2011, production was estimated to be about 60% gem quality; and in 2012–14, production is estimated to be about 80% gem quality.
[17]About 85% gem quality and 15% industrial quality.
[18]About 40% gem quality and 60% industrial quality.
[19]About 10% gem quality and 90% industrial quality.

Source: Kimberley Process Certification Scheme.