

MANUFACTURED ABRASIVES

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Manufactured abrasives include fused aluminum oxide, silicon carbide, metallic shot and grit, aluminum-zirconium oxide, and boron carbide. This report presents information on fused aluminum oxide, silicon carbide, and alumina-zirconia oxide produced in the United States and Canada; data on metallic shot and grit and on boron carbide produced in the United States also are included. Except where noted, quantities are reported in metric units.

Fused Aluminum Oxide

Legislation and Government Programs.—The Department of Defense reported that the National Defense Stockpile (NDS) at yearend 1996 contained 141,812 tons of crude fused aluminum oxide valued at \$33.3 million and 29,882 tons of fused aluminum oxide abrasive grain valued at \$15.7 million. However, stockpile goals for crude fused aluminum oxide and fused aluminum oxide abrasive grain were reduced to zero prior to 1996; Federal law authorizes the disposal of all aluminum oxide in the NDS. Thus, in 1996, the Department of Defense sold 40,824 tons of stockpiled crude fused aluminum oxide valued at \$8.9 million and 2,633 tons of stockpiled fused aluminum oxide abrasive grain valued at \$1.4 million.

Production.—Data in this report on the production, sale, and use of fused aluminum oxide are based on a survey of operations in the United States and Canada conducted by the U.S. Geological Survey (USGS). Data on production and on material sold or used were collected from 5 companies operating 10 plants in the United States and Canada and represented the entire industry. (See table 1.)

Total output of fused aluminum oxide in 1996 was 144,000 tons, slightly less than in 1995. Production of regular-grade fused aluminum oxide was 127,000 tons, about the same as in 1995. Production of high-purity fused aluminum oxide in 1996 decreased 15% to 17,000 tons. (See table 2.)

Consumption.—Fused aluminum oxide in the form of graded grain has several end uses. The total value of U.S. producer sales of fused aluminum oxide graded grain for all uses was estimated to be over \$100 million in 1996. Specific applications of graded grain in 1996 included bonded abrasives, coated abrasives, refractories, tumbling media, blasting abrasives, polishing/buffing compounds, and antislip abrasives.

Prices.—The USGS does not collect price data on the various grades of fused aluminum oxide. However, it does collect data on the value of output reported by producers. The average value of regular fused aluminum oxide in 1996, as reported by producers, was \$353 per ton. The reported average value of high purity fused aluminum oxide in 1996 was \$576. Prices of abrasive grain produced from these materials and sold to consumers are significantly higher. In 1996, prices generally

ranged from \$0.25 to \$0.70 per pound for regular-grade grain and from \$0.40 to \$0.80 per pound for high-purity grain.

Foreign Trade.—Imports of crude fused aluminum oxide decreased sharply in 1996 to 81,100 tons (valued at \$35.5 million), while imports of ground and refined fused aluminum oxide rose significantly to 49,400 tons (valued at \$37.2 million). Most of the crude imports came from Canada; most of the ground and refined material came from China. A small amount of imported fused aluminum oxide was reexported during 1996.

Exports of all fused aluminum oxide in 1996 increased slightly to 11,900 tons. These exports were valued at \$18 million. Most of the exports went to Canada and Mexico.

Silicon Carbide

Legislation and Government Programs.—As of December 31, 1996, the National Defense Stockpile contained 14,458 tons of silicon carbide valued at \$6.9 million. Prior to 1996, however, the stockpile goal for silicon carbide was reduced to zero. Thus, under Federal legislation authorizing disposal of all silicon carbide in the NDS, the Department of Defense sold over 4,000 tons of stockpiled silicon carbide (valued at more than \$2 million) in 1996.

Production.—The USGS collects production and sales information from all domestic and Canadian producers of silicon carbide. Three companies operating three plants (two in the United States and one in Canada) produced silicon carbide in 1996. Table 2 shows production and estimated production values for these companies in 1995 and 1996.

Consumption.—Silicon carbide in the form of graded grain has several end uses. The total value of U.S. producer sales of silicon carbide graded grain for all uses in 1996 was estimated to be approximately \$90 million. End uses of the grain included bonded abrasives, coated abrasives, refractories, tumbling media, blasting abrasives, wiresawing abrasives, polishing/buffing compounds, and antislip abrasives.

Prices.—The USGS does not collect price data on the various grades of silicon carbide. Based on Department of Defense stockpile sales and other information from industry, however, the average value of abrasive-grade silicon carbide at the point of manufacture was estimated to be \$490 in 1996.

Foreign Trade.—Imports of crude silicon carbide rose slightly in 1996 to 167,000 tons (valued at \$70 million). Imports of silicon carbide in ground or refined form nearly doubled to 14,400 tons (valued at \$24 million). Most of the crude imports came from China; one-half of the ground or refined imports came from Brazil. A small amount of imported silicon carbide was reexported in 1996.

Exports of crude silicon carbide declined sharply from 1995 exports to 566 tons (valued at \$1.6 million), while exports of

refined and ground silicon carbide declined 13% to 13,653 tons (valued at \$14 million). Most crude exports went to Japan and Mexico; most refined and ground material went to Canada.

Aluminum-Zirconium Oxide

Two firms, Norton Company and Washington Mills, produced fused aluminum-zirconium oxide for abrasive applications (e.g., resin-bonded grinding wheels) in 1996; output was from three plants, two in the United States and one in Canada. In order to protect company proprietary information, the USGS does not publish detailed data regarding this production. Import and export data on aluminum-zirconium oxide are not collected by the U.S. Government.

Boron Carbide

Only one firm, Washington Mills, is known to be a commercial producer of boron carbide in the United States. Boron carbide is used for grinding and lapping operations previously possible only with diamond dust (Wellborn, 1996); it also is molded to form highly wear-resistant products.

Although production data are not available, the USGS has the following U.S. trade information on boron carbide in 1996: U.S. imports reached 196 tons (valued at \$4.7 million), primarily from China, Germany, and the Ukraine; exports were 6.8 tons (valued at \$0.6 million), principally to Western Europe.

Metallic Abrasives

Production.—Data in this report on the domestic production, sale, and use of metallic abrasives are based on a survey of domestic operations conducted by the USGS. Production and sold or used data were collected from 13 companies operating 14 plants in the United States and accounted for virtually all of the domestic industry. (See table 3.)

Steel shot and grit account for nearly all of metallic abrasives produced domestically. (See table 4.) The quantity of steel shot and grit produced in 1996 increased slightly relative to 1995 output. Total value grew 4% in 1996 and the average value per ton increased to \$441.

During 1996, six companies, including two new firms, reported production of cut wire shot. The production of cut wire shot increased significantly in 1996.

Consumption.—The quantity of steel shot and grit sold or used in 1996 increased slightly relative to 1995; total value increased 3%. The average value per ton sold or used during the year increased slightly to \$458. It is estimated that the quantity of cut wire shot sold by domestic producers in 1996 increased significantly.

Prices.—The USGS does not collect price data on metallic abrasives. However, data on the value of production are collected. The values of production and shipments reported by metallic abrasive producers in 1996 are shown in table 4.

Foreign Trade.—U.S. imports of metallic abrasives declined 21% to 20,200 tons in 1996. The value of these imports decreased 16% to \$12.2 million. Most of the imports came from Canada. A small quantity of imported metallic

abrasives was reexported in 1996.

Domestic exports of metallic abrasives totaled 24,900 tons in 1996, a decline of 20% from those of 1995. The total value of the 1996 exports was \$15.2 million, slightly less than the 1995 value. Most of the exports in 1996 went to Canada.

Outlook

Further consolidation of the fused aluminum oxide and silicon carbide industries will continue through closures, acquisitions, and joint ventures worldwide in the remaining 1990's. China will continue to grow as a supplier of both materials in North America and Western Europe; producers in Eastern and Central Europe may become more important suppliers as well. The trends toward consolidation and the emergence of new regional suppliers have been more pronounced in recent years (Bolger, 1996; O'Driscoll, 1997).

Trends in foundries, machine tool industries, metal fabrication plants, and other industrial operations where manufactured abrasives are used for cutting, shaping, and polishing metals will continue to propel demand for these abrasives. However, the substitution of metals by plastics and other materials could curb demand for some of these abrasives. Less influential demand factors include near-net-shape metal casting and environmental regulations that reduce chemical finishing of metals; the former tends to decrease demand for abrasive finishing of metals, while the latter would increase such demand.

Automotive vehicle manufacturing, a major metals consumer, will indirectly influence demand for manufactured abrasives. Consequently, domestic consumption of manufactured abrasives will reflect somewhat the quantity and the metal content of automotive vehicles built in the United States. Some smaller markets (e.g., manufactured abrasives used for machining advanced ceramics and metal matrix composites) show promise of significant growth.

References Cited

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SOURCES OF INFORMATION

USGS and USBM Publications

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Other

Abrasives, Industry & Trade Summary. U.S. International Trade Commission, May 1995.
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TABLE 1
CRUDE ARTIFICIAL ABRASIVES MANUFACTURERS IN 1996

Company	Location	Product
Dakota Catalyst Products, Inc.	Williston, ND	Fused aluminum oxide (regular and high-purity).
The Exolon-Esk Co.	Hennepin, IL	Silicon carbide.
Do.	Thorold, Ontario, Canada	Fused aluminum oxide (regular).
Treibacher Schleifmittel Corp.	Niagara Falls, NY	Fused aluminum oxide (high-purity).
Do.	Niagara Falls, Ontario, Canada	Fused aluminum oxide (regular).
Saint-Gobain/Norton Co.	Huntsville, AL	Fused aluminum oxide (high-purity) and aluminum-zirconium oxide.
Do.	Worcester, MA	General abrasive processing.
Do.	Chippawa, Ontario, Canada	Fused aluminum oxide (regular and high-purity) and aluminum-zirconium oxide.
Do.	Shawinigan, Quebec, Canada	Silicon carbide.
Superior Graphite Co.	Hopkinsville, KY	Do.
Washington Mills Electro Minerals (Canada) Corp.	Niagara Falls, Ontario, Canada	Fused aluminum oxide (regular).
Washington Mills Electro Minerals (U.S.) Corp.	Niagara Falls, NY	Fused aluminum oxide (high-purity), aluminum-zirconium oxide, and boron carbide.
Washington Mills Ltd.	Niagara Falls, Ontario, Canada	Fused aluminum oxide (regular).

TABLE 2
PRODUCTION OF CRUDE SILICON CARBIDE AND FUSED ALUMINUM OXIDE
IN THE UNITED STATES AND CANADA 1/

Product	1995			1996		
	Quantity (metric tons)	Value (thousands)	Yearend stocks	Quantity (metric tons)	Value (thousands)	Yearend stocks
Silicon carbide	75,400 r/	\$37,400 e/	9,640	73,600	\$36,000 e/	6,760
Aluminum oxide:						
Regular: Abrasives and refractories	126,000	45,100	15,600	127,000	44,900	13,300
High purity	20,100 r/	9,460 r/	774 r/	17,000	9,800	1,870
Total	146,000 r/	54,600 r/	16,400 r/	144,000	54,700	15,200

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 3
U.S. PRODUCERS OF METALLIC ABRASIVES IN 1996

Company	Location	Product (shot and/or grit)
Abrasive Materials, Inc.	Fortville, IN	Cut wire, steel.
Barnsteel Abrasives	Butler, PA	Iron and steel.
Chesapeake Specialty Products	Baltimore, MD	Steel.
Ervin Industries, Inc.	Adrian, MI	Do.
Do.	Butler, PA	Do.
Frohn North America, Inc.	Austell, GA	Cut wire.
Marwas Steel Co.	Scottsdale, PA	Do.
Metaltec Steel Abrasives Co.	Canton, MI	Steel.
National Metal Abrasive Co.	Wadsworth, OH	Do.
Peerless Metal Powders & Abrasive	Detroit, MI	Do.
Pellets, Inc.	Tonawanda, NY	Cut wire.
The Platt Brothers, Inc.	Waterbury, CT	Do.
Premier Shot Co.	Cleveland, OH	Do.
The Wheelabrator Co.	Bedford, VA	Steel.

TABLE 4
ANNUAL PRODUCTION AND SHIPMENTS FOR METALLIC
ABRASIVES IN THE UNITED STATES, BY PRODUCT 1/ 2/

Product	Production		Shipments	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1995:				
Steel shot and grit	234,000	\$102,000	214,000	\$96,600
Cut wire shot and other 3/	11,400	8,550	12,400	41,900
Total	246,000	110,000	227,000	184,000
1996:				
Steel shot and grit	240,000	106,000	218,000	99,700
Cut wire shot and other 3/	8,060 e/	14,800 e/	8,620	21,100
Total	248,000	121,000	226,000	121,000

e/ Estimated.

1/ Excludes secondary (recycle) producers.

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Includes aluminum, stainless steel, zinc, and chilled iron shot and grit (1995 only).