



SIC CODES: 3291

NAICS CODES: 32791

Industry Overview

About **300 companies** in the US manufacture abrasive products, with combined annual **revenue of \$4 billion**. Companies in the industry are privately owned or are divisions of larger companies, including General Electric, Saint-Gobain, and 3M. Although a handful of companies have more than 500 employees and annual sales over \$200 million, the average company has fewer than 50 workers and annual sales less than \$10 million. The industry is **highly concentrated**; the 50 largest companies hold almost 90 percent of the market.

COMPETITIVE LANDSCAPE

Demand for manufactured **industrial products** is the major driver of sales for abrasives. The profitability of individual companies depends on good **marketing**, as many products are considered commodities. Larger companies can make large investments in new technology. Small companies can compete effectively by specializing in products for particular manufacturing functions. The industry is highly automated; in the larger companies, annual revenue per worker is about \$500,000.

PRODUCTS, OPERATIONS & TECHNOLOGY

Abrasive products are made of **grains of hard minerals** and are used to produce and maintain a wide variety of manufactured products made of metal, plastics, glass, and wood. Abrasives are used to **shape** materials through grinding; **smooth** surfaces during manufacture; **remove** surface layers of paint or corrosion; **cut** hard materials like concrete or steel; and **polish**, buff or "lap" finished products. The two major types of abrasive products are coated and bonded.

Coated products consist of grains of a hard mineral that are bonded to a backing sheet, belt, pad or wheel made of paper, nylon cloth, rubber, or other material. Various glues and urea or phenolic resins enable the bonding. Coated products are made in two coating stages: first a "make" coat is applied that binds the abrasive mineral to the backing, then a "size" coat is applied on top to hold the abrasive layer together.

Bonded products consist of mineral grains mixed and embedded in a matrix that is molded into various shapes -- such as grinding wheels, cutoff wheels, disks, or blades -- and then subsequently hardened. The matrix may be made of metal, resins or rubbers that must eventually be cured to harden, or vitreous minerals fired in an oven to produce the hardened product. A typical bonded grinding wheel may contain 90 percent abrasive and 10 percent vitrified bond material by weight, and 40 percent air channels by volume. Air channels provide porosity to enhance cooling.

The **minerals** used in abrasives include **natural ones** like **emery** and **garnet**, and **synthetics** like **aluminum oxide**, **zirconia alumina**, **silicon carbide**, **cubic boron nitride (CBN)**, and **synthetic diamond**. Synthetics are produced in high temperature furnaces from mixtures of natural minerals.

Cubic boron nitride and synthetic diamond are called **superabrasives**, and may come in the form of polycrystalline diamond (**PCD**) and polycrystalline cubic boron nitride (**PCBN**). The harder minerals are more expensive to produce, partly because they require a much higher energy input. Superabrasives are usually made into electroplated products--a single layer of mineral held in place by a nickel bond matrix--or resin bond products that hold mineral to a depth of 1/16 to 1/4 inch.

Minerals are graded into many different grit sizes. The size, orientation, and concentration of mineral grains in an abrasive product determine the product's **abrasion** or **"stock removal" characteristics**. Manufacturers buy abrasive

minerals in the form of grains, powders, or flours from specialty producers. Raw materials account for about 40 percent of the sales value of finished abrasive products.

Because of the many different types of abrasive minerals, backings, glues, resins, matrix materials, and product shapes and sizes, there are **thousands of different abrasive products**. An industry leader can produce 250,000 bonded products and 38,000 coated products. The large variety reflects the many different uses and the various hand, power, and industrial machines abrasive products are used in. Abrasives are essentially a **consumable and replaceable** part of a machine. Many companies in the industry make products to be used with particular makes and models of machines, although many standard products will fit many different machines.

SALES & MARKETING

Major customers are manufacturers of automobiles, aircraft, steel products, and furniture; the construction industry; consumer do-it-yourselfers (DIY); and the automobile aftermarket of machine and body shops. Abrasives in the form of grinding wheels are essential in grinding steel parts to precise dimensions -- as in the manufacture of car and aircraft engines and camshafts -- and are heavily used as saw blades to cut concrete and steel.

Manufacturers sell products mainly through non-exclusive arrangements with independent **distributors** of industrial products, **distributor chains** like Fastenal, and construction and home improvement **retail chains** like Home Depot. Some manufacturers also sell directly to large end-user customers.

Competition is intense because most products are essentially **similar-priced commodities**, even though each company's products may have slightly different characteristics. Trade shows are an important source of new business. Auto racing sponsorship is an important sales tool to the auto after-market. Distributors rely heavily on manufacturers to provide technical support to customers.

FINANCE & REGULATION

Specific financial information about abrasives manufacturers is unavailable because none of the abrasives-specific companies is publicly traded. However, the financial statements of Saint-Gobain, which owns the abrasives brands Norton and Carborundum, indicate a **net margin** of 10 percent and annual **capital investment** of 3 percent. Because of the large number of products, manufacturers must carry a fairly **large inventory** of finished products for availability to distributors.

Most abrasives manufacturers have no particular environmental pollution or OSHA problems, although the use of glues and resins requires attention to air quality and waste disposal.

REGIONAL & INTERNATIONAL ISSUES

Companies producing abrasives are heavily concentrated in the manufacturing-intense **states** of Illinois, Michigan, Ohio, New York, and Massachusetts.

Imports hold about 25 percent of the market. The largest importers to the US are China, Canada, and Germany. **Exports** go mainly to Canada, Mexico, and Germany.

HUMAN RESOURCES

Workers in abrasives manufacture are semi-skilled and earn a bit more than the \$16 per hour made in 2005 by the average US worker. Annual personnel turnover for manufacturing industries is close to 30 percent. The annual injury rate per 100 workers for the industry is about 7 percent, slightly higher than the 6 percent rate for all manufacturing.

Business Challenges

CRITICAL ISSUES

Strong Dependence on Domestic Manufacturing - Demand for abrasive products is closely linked to the level of industrial production. Abrasives are used in the manufacture of long-lasting, expensive items like auto, aircraft, and construction parts, demand for which can be highly cyclical. The abrasive industry has some protection against cycles because demand in the consumer, home, and auto aftermarkets can rise when the general economy slows. US manufacturing fell 5 percent during the last recession.

- ▶ The US manufacturing economy failed to grow in January as the Purchasing Managers Index (PMI), an indicator of manufacturing activity, decreased 2.1 percent from the previous month.

Competition from Imports - China holds almost 50 percent of world production capacity for aluminum oxide and silicon carbide, two leading synthetics in abrasives. China has become the largest source of abrasive imports to the US, surpassing Canada and Germany. From 2000 to 2005, abrasive shipments to the US from China grew 134 percent.

- ▶ Abrasive imports from China to the US rose 15.8 percent in 2006 compared to 2005.

OTHER BUSINESS CHALLENGES

Small Companies Can't Afford Research & Development (R&D) - The increasing sophistication of some abrasive technology makes it difficult for smaller companies to keep pace with larger ones. While companies like Norton, an abrasives brand of Saint-Gobain, and the divisions of GE and 3M can afford a research center, most companies in the industry can't afford research. A two-tier industry is emerging, with bigger companies manufacturing more of the superabrasives, and smaller ones producing mainly commodity items.

High Freight, Storage Expenses - Bulky abrasive raw materials require expensive freight and storage. Shipping is by rail car, flatbed truck, or cargo ship. The smaller the shipment, the more expensive the freight bill and lower the margin per unit. Because bulk abrasives require a lot of storage, rail cars, where abrasives are stored and carried, are the most effective way of transport.

Consumer Market Channels Through Big Retailers - The market for consumer abrasives has rapidly consolidated in recent years, as large retailers like Home Depot, Lowe's, and AutoZone have grown. Access to such retailers is difficult for smaller abrasive manufacturers that can't supply a national network and may not have the lowest prices. Large retailers carry only a few brands.

Trends & Opportunities

BUSINESS TRENDS

Company Specialization - Few companies can produce the full range of abrasive products; most specialize in one or several sectors, producing only industrial or consumer products, or producing mainly for the auto or machine shop industries. While the manufacturing technology of the industry is well-known, the technical expertise to advise customers on the best ways to apply abrasive products for a particular purpose is very specific. Because very little scientific knowledge about abrasives exists, long practical experience is the basis for most technical knowledge and advice, is a major selling tool, and is difficult to acquire.

Customer Consolidation - Consolidation among customers in the auto parts and aircraft parts industries is opening opportunities for large abrasive manufacturers to develop nationwide sales relationships with big customers. Although there are few economies of scale in manufacturing operations, there are large distribution efficiencies for companies that can provide a wide range of abrasive products to large customers.

Internet Selling - The larger abrasive manufacturers allow customers to order products through Internet sites. To avoid competing with distributors, however, manufacturers like Saint-Gobain's Norton brand serve as a central ordering site but sell through distributors. Smaller companies use their Internet sites mainly to help customers find products, then steer them to local distributors.

New Designs Lead to Productivity - Auto, aerospace, and electronics manufacturers are demanding more high-performance applications. Improvements in the design of diamond wheels used to finish ceramics can be key to cost-effective manufacturing. Metal-bond design wheels created for longer wear can lead to shorter cycle times and longer life, thereby impacting customer machining costs.

More Use of Superabrasives - Synthetic diamond and cubic boron nitride products, called "superabrasives," are being used more extensively in industrial applications even though their cost is higher. The longer product life and reduced machine downtime (switching and "dressing" a grinding wheel) associated with superabrasives in many cases more than make up for the higher initial cost. Production of aluminum oxide and silicon carbide, the bulk of the traditional minerals used for abrasives, has declined in North America in recent years.

New Ceramics Technology - Abrasive growth has come in part from new advances in the material science of ceramics,

used in making abrasives. New ceramics are used to manufacture superabrasives and grind wheels. In the next five years, electronic ceramics are forecast to grow by over 11 percent, structural ceramics by almost 11 percent, advanced coatings by almost 9 percent, and ceramics for chemical processing and environmental applications by over 7 percent.

Deburring Advances - Deburring, a common process using abrasives, was a major bottleneck in the machining process for most manufacturers. Now, however, manufacturers can choose automatic deburring using new abrasive technologies and industrial robots, or traditional manual deburring using handheld tools. Automatic deburring, while expensive to install, produces fewer health hazards to workers. Burrs, an undesirable projection of materials, occur during formation of most manufactured products, from auto parts to plastic pens, and create problems in assembly, painting, and product quality.

INDUSTRY OPPORTUNITIES

Increases in Precision Tooling - The evolution of the US economy toward more specialized manufacturing requires smaller, more accurately shaped parts. Precision grinding is the only way to produce the tight tolerances that make smaller, more intricate parts fit properly. Abrasive manufacturers can capitalize on this shift in manufacturing technology by looking for customers in the electronics and instruments industries, rather than in steel and autos. Precision abrasives are coated abrasives, slurries, and polishing agents used for various applications, like semiconductors, fiber optics, lapidary, auto parts, and dentistry.

New Products with Longer Life - Customers will spend more for abrasives with longer average life spans, according to flap wheel and disc manufacturers. New heavy-duty flap wheels and non-woven discs save hours on certain applications because they reduce total finishing time and eliminate the need for an additional finishing process.

Application to New Manufacturing Materials - Stronger steel, concrete, and new ceramics require better abrasives to cut and shape them. The superabrasive segment of the industry has been growing, partly because conventional abrasives don't work very well with harder materials. Ceramics are increasingly viewed as low-weight alternatives to steel in car parts, including engines.

Exotic Applications in Electronics - High-tech uses for abrasives have emerged in the electronics industry. Silicon chip manufacture requires high-accuracy grinding of the chip surface between the application of layers of circuits. New abrasive uses are likely to emerge as optical switches and optical computers are developed. Most abrasive companies will lack the technological resources to develop these, but their knowledge of abrasives would be useful in partnerships with technology companies.

More Uses in Plastics Manufacture - Metals and wood have been the focus of abrasive manufacturers, but the use of these materials in manufactured products is dropping, while plastics use is increasing. Developing abrasive products, especially for plastics applications, would find a receptive market.

Chemical Vapor Deposition Diamonds - Conventional abrasive products are made by mixing grains of abrasive minerals with a bonding agent. Chemical vapor deposition produces a solid film of hard material like diamond on the surface of a tool that has already been shaped. The technology is currently limited to small tools, but will eventually expand to larger surfaces, possibly producing greatly superior grinding wheels. Producing abrasive tools like these will require entirely different manufacturing processes than most producers are currently familiar with.

Executive Insight

CHIEF EXECUTIVE OFFICER - CEO

Determining Merchandise Mix

Customers in the manufacturing, construction, repair, and consumer markets have different product requirements. Because of the many different types of abrasive minerals, bonding materials, shapes, and sizes, the industry makes 300,000 different products. Companies typically specialize in products for specific end-use markets.

Planning for Demand Cycles

Abrasives are heavily used by US manufacturers of machinery and metal products, whose output is cyclical. During an economic downturn, machinery and metal product output could decline 15 percent or more. To maintain production levels under diverse economic conditions, companies that primarily supply a cyclical industry should cultivate customers

in counter-cyclical industries, even if they are not as profitable.

CHIEF FINANCIAL OFFICER - CFO

Securing Low-Cost Raw Materials

Raw materials are bought from a small number of specialty producers. Major raw materials are aluminum oxide, zirconia alumina, silicon carbide, synthetic diamond, and cubic boron nitride (CBN). China has become a major exporter of low-cost abrasive raw materials to the US.

Seeking Price Increases for Specialty Products

Industry prices overall have been flat for the last 10 years, partly due to imports from China. From 1994 to 2004, the average wholesale price for abrasive products rose just 5 percent. Prices for some products have fared better, especially products containing superabrasives.

CHIEF INFORMATION OFFICER - CIO

Developing Advanced Products

As US industrial manufacturers use harder metals and ceramics in products, abrasives manufacturers must produce harder abrasives to shape them. Polycrystalline diamond and polycrystalline cubic boron nitride are types of superabrasives that may be embedded in a matrix of nickel to produce specialty grinding wheels and other products.

Getting ISO Certified

Many abrasives manufacturers have earned ISO 9000 certification as a statement to their customers that the company has a quality management system in place. These manufacturing processes strive for zero manufacturing defects and products of consistently high quality, important value characteristics in industrial abrasives sales.

HUMAN RESOURCES - HR

Hiring and Training Workers with Technical Knowledge

Because of the large number of abrasive products, customers need help choosing the product most suitable for their use. Customer service and sales personnel need technical knowledge of the various abrasive products and of the manufacturing processes in which they are used.

Retaining Key Employees in Shrinking Industry

Lower demand has reduced the number of employees in the industry. Since 2000, industry revenue and jobs declined by 25 percent. Companies want to retain workers with the most technical knowledge.

VP SALES/MARKETING - SALES

Combating Import Competition

As imports have taken a larger share of the lower-end abrasives market in the US, domestic manufacturers have concentrated on expanding demand for high-end specialty products. Superabrasives like synthetic diamond and cubic boron nitride have higher profit margins than ordinary abrasives. Imports to the US from China grew 50 percent in 2004.

Developing Export Markets

Exports account for less than 20 percent of US abrasives production, but include specialty products like superabrasives. In 2004, exports increased more than 25 percent to Mexico, Germany, England and Taiwan.

Call Preparation Questions

CONVERSATION STARTERS

How does the company mitigate the cyclical nature of its manufacturing industry customers?

Demand for abrasive products is closely linked to the level of industrial production.

What impact do foreign imports have on the company?

The increasing sophistication of some abrasive technology makes it difficult for smaller companies to keep pace with larger ones.

How much does the company spend annually on research & development (R&D)?

China holds almost 50 percent of world production capacity for aluminum oxide and silicon carbide, two leading synthetics in abrasives.

How is the company capitalizing on customer need for more precise tooling?

The evolution of the US economy toward more specialized manufacturing requires smaller, more accurately shaped parts.

What product innovations would provide the company new revenue sources?

Customers will spend more for abrasives with longer average life spans, according to flap wheel and disc manufacturers.

What opportunities does the company see in superabrasives?

Stronger steel, concrete, and new ceramics require better abrasives to cut and shape them.

QUARTERLY INDUSTRY UPDATE**What changes in the US economy affect company demand levels the most?**

Industrial production increases indicate healthy spending by manufacturers on abrasives, according to economists; industrial production overall increased 3 percent in December 2006 from a year ago.

What product pricing changes has the company made recently?

Prices of abrasive products increased 2 percent in 2006 from 2005, after remaining steady in recent years.

OPERATIONS, PRODUCTS, AND FACILITIES**What products does the company manufacture?**

Coated abrasives, bonded abrasives, superabrasives are major categories.

Does the company specialize in a particular product line?

Most companies in the industry specialize.

How many different items does the company produce?

Saint-Gobain's Norton brand makes 250,000 bonded and 38,000 coated products.

How many production facilities does the company operate?

The typical manufacturer has one production plant.

What major raw materials does the company mainly use?

Mineral grains like aluminum oxides, silicon carbide, cubic boron nitride, and synthetic diamond are usual, as are bonding and backing materials.

Who does the company buy its raw materials (or components) from?**How are production levels determined?****How large do inventories become throughout the year?**

Because of the large number of products, manufacturers must keep a fairly large inventory of finished product available to distributors.

What percentage of production costs is due to labor?

The average is 20 percent.

Does the company have a formal cost-reduction program?

Materials are about 50 percent of production costs.

What potential environmental problems exist?

The wastestream might include toxic bonding and curing agents.

Does the company manufacture products other than abrasives?**CUSTOMERS, MARKETING, PRICING, COMPETITION**

What end-use markets does the company serve?

The auto, aircraft, steel, construction, home market, and auto aftermarket are major end-users.

How large a geographical area does the company serve?

Many companies in the industry have a large regional presence.

How does the company find new customers?

Advertising in trade publications, using a sales force and manufacturer representatives, and attending trade shows are common.

Does the company sell through distributors or directly to big customers?

Manufacturers sell products mainly through non-exclusive arrangements with independent distributors of industrial products, distributor chains like Fastenal, and hardware and construction chains like Home Depot. Some companies also sell directly to large end-use customers.

How many distributors carry the company's products?**At what major trade shows does the company exhibit?**

Trade shows are an important source of new business.

Does the company provide technical support to end-use customers?

Distributors rely heavily on manufacturers to provide technical support to customers. Generally, only larger companies have a significant research & development (R&D) function for new materials and uses.

How does the company price its products in relation to competitors?

Competition is intense because most products are essentially similar-priced commodities made by several companies, even though each may have slightly different characteristics.

Who are the major competitors for the company's products?

Small companies effectively compete with larger ones by specializing in a particular product segment or user industry.

Is a company in the industry the "price leader"?

Possibly Saint-Gobain's Norton abrasives brand.

What competitive advantage does the company have?

Highest quality product, unique product, lowest prices, best service, etc.

REGULATIONS, R&D, IMPORTS AND EXPORTS**Does the company have trouble meeting environmental standards?**

This industry has a relatively nontoxic wastestream.

Does the company have trouble meeting OSHA or other labor standards?

Most abrasive manufacturers have no particular environmental pollution or OSHA problems, although the use of glues and resins requires attention to air quality and waste disposal.

Are patents on products or processes important to the company?**Does the company compete with imports?**

China and Germany are the main importers into the US.

Does the company rely on foreign suppliers for raw materials?

Some raw materials, such as silicon carbide, have few domestic suppliers.

Does the company have sizable exports?

The US imports more than it exports in abrasives.

ORGANIZATION AND MANAGEMENT**Is the company a division of a larger corporation?**

Companies in the industry are privately owned or are divisions of larger companies.

Does the company have subsidiaries?**Is management centralized or decentralized?**

Does the company have dominant shareholders?

Has the company had recent management turnover?

What is the typical annual employee turnover?

Annual personnel turnover for manufacturing industries is close to 30 percent.

FINANCIAL ANALYSIS

Has the company been profitable in recent years?

Profitability depends on sales volume, as many companies produce commodity products.

Does the company have uneven cash flow during the year?

Cash flow can be uneven because of uneven sales, receivables, inventory, production.

Has the company recently made big capital investments? If so, how were they financed?

How much does the company spend annually on research & development (R&D)?

Many companies in the industry are too small to do significant research.

BUSINESS AND TECHNOLOGY STRATEGIES

How does the company plan to grow?

Is the company developing new products or new applications?

Does the company work with end-users to develop new applications?

Does the company have alliances with other companies?

Alliances can be used to jointly develop or market a new product, for example.

Has the company made acquisitions during the last few years?

Does the company use an Internet site for its distributors?

Financial Information

COMPANY BENCHMARK INFORMATION

ABRASIVE PRODUCT MANUFACTURING (NAICS: 327910)

12 Month Rolling Data Period	Last Update June 2006	
Small Company Data	Sales < NA	
Table Data Format	Median Values	

	US Private Company Data	
	Aggregate	Small Company
Company Count in Analysis	25	-

Income Statement		
Net Sales	100%	100%
Gross Profit	24.2%	-
Operating Income	3.8%	-
Net Profit After Tax	0.8%	-

Balance Sheet

Cash	5.8%	-
Accounts Receivable	23.3%	-
Inventory	30.1%	-
Total Current Assets	62.9%	-
Total Fixed Assets	22.1%	-
Other Non-Current Assets	15.0%	-
Total Assets	100%	100%
Accounts Payable	10.5%	-
Total Current Liabilities	24.7%	-
Total Long-Term Liabilities	9.7%	-
Net Worth	65.6%	-

Financial Ratios

(Click on any ratio for comprehensive definitions)

Quick Ratio	0.98	-
Current Ratio	2.59	-
Current Liabilities to Net Worth	66.0%	-
Current Liabilities to Inventory	103.5%	-
Total Liabilities to Net Worth	73.0%	-
Fixed Assets to Net Worth	48.6%	-
Collection Period	46.1	-
Inventory Turnover	8.1	-
Assets to Sales	47.0%	-
Sales to Working Capital Ratio	5.2	-
Accounts Payable to Sales	6.0%	-
Return on Sales	1.0%	-
Return on Assets	1.0%	-
Return on Investment	2.0%	-
Sales per Employee	\$98,112	-
Net Profit per Employee	\$271	-
Interest Coverage	11.5	-

Financial industry data provided by Fintel -- offering leading benchmarking with a database of over 900 industries. Utilize financial analysis through profitability, liquidity, sustainable growth rate, business valuation, custom research, and other tools. Visit us on the web at www.fintel.us/firstresearch to find out how we can help you.

ECONOMIC STATISTICS AND INFORMATION

Change in Producer Prices - Bureau of Labor Statistics

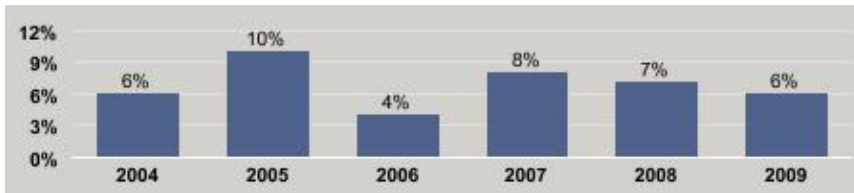
2002	2003	2004	2005	2006	Apr 07
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PCU327910 Abrasive products	-0.1%	0.5%	0.0%	2.9%	3.8%	2.7%
PPI	-0.7%	2.5%	4.2%	5.5%	4.0%	3.2%

Industry Forecast

The output of US nonmetallic mineral products, which includes abrasives manufacturing, is forecast to grow at an annual compounded rate of 7.4 percent between 2006 and 2009.

Nonmetallic Mineral Products Growth Dips Then Recovers



First Research forecasts are based on INFORUM forecasts that are licensed from the Interindustry Economic Research Fund, Inc. (IERF) in College Park, MD. INFORUM's "interindustry-macro" approach to modeling the economy captures the links between industries and the aggregate economy.

First Research Opportunity Rating

The First Research Opportunity Rating is First Research's estimate of industry performance vs. industry risk over the next 12 to 24 months.



- ▶ Demand grows with industrial production
- ▶ But demand highly cyclical
- ▶ And high investment required for product development

Weblinks & Acronyms

Industry Websites

Abrasive Engineering Society

<http://www.abrasiveengineering.com>

Technical information.

Abrasive Engineers Glossary

<http://www.abrasiveengineering.com/glossary.htm>

Glossary of industry terms.

American Machine Tool Distributors' Association

<http://www.amtda.org>

Provides current information on events, activities, and related industry data.

Ceramic Industry

<http://www.ceramicindustry.com>

Articles.

Coated Abrasive Fabricators Association

<http://www.cafa-info.org/>

News, events, and information.

Industrial Diamond Association of America

<http://www.superabrasives.org/FinerPoints.php3>

Dedicated to the promotion, education and use of superabrasives.

Industrial Distribution - Abrasives & Cutting Tools Specialized News Section

<http://www.manufacturing.net/ind/community/1916/Abrasives+%26+Cutting+Tools>

News.

Norton Abrasives

<http://www.nortonabrasives.com>

Manufacturer website.

Radiac Abrasives

<http://www.radiac.com>

Manufacturer website.

SuperAbrasives, Inc.

<http://www.superabrasives.com/>

Application news.

The A to Z of Materials

<http://www.azom.com/details.asp?ArticleID=1400>

Types of abrasives.

Glossary of Acronyms

BAM - Aluminum magnesium boride

CBN - Cubic boron nitride

CVD - Chemical vapor deposition

ISM - Institute for Supply Management

ITC - International Trade Commission

PCBN - Polycrystalline cubic boron nitride

PCD - Polycrystalline diamond

SiC - Silicon carbide

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