Abrasives are ideal for blasting light gauge metals, plastics, and other semi-delicate surfaces. Small particles yield deep profiles, which is helpful in removing multi-layers of material. Conversely, large particles create shallow profiles and are better suited for heavy layers of paint and rust. Angular abrasives are best for heavy layers of paint and rust, while round abrasives are better suited for light layers of paint and rust. Angular abrasives have a more angular shape, while round abrasives are more spherical. Angular abrasives are more effective at Removing rust and paint, while round abrasives are more effective at smoothing and finishing surfaces. Abrasive density is of lesser consideration than the other properties, but increases in importance when both ends of the spectrum are considered. Abrasive hardness is measured on the Mohs scale (steel abrasive = 9), with lower hardness being rougher and higher hardness being smoother. Abrasive hardness is an important consideration when selecting an abrasive for a specific application. Abrasive blasting is a cost-effective and efficient method for removing paint, rust, and other contaminants from metal surfaces. It is commonly used in the automotive, construction, and manufacturing industries. Abrasive blasting is an excellent method for preparing metal surfaces for paint, priming, or coating. The equipment and materials used in abrasive blasting are relatively inexpensive and easy to use, making it an attractive option for a wide range of applications. Abrasive blasting is a versatile and effective method for preparing metal surfaces for a variety of applications, from automotive repair to large-scale industrial projects. It is a cost-effective and efficient method that is easy to use and maintain. Abrasive blasting is a popular method for preparing metal surfaces for painting or coating, and it is used in a wide range of industries, from automotive repair to large-scale industrial projects. It is a versatile and effective method that is easy to use and maintain. Abrasive blasting is a popular method for preparing metal surfaces for painting or coating, and it is used in a wide range of industries, from automotive repair to large-scale industrial projects. It is a versatile and effective method that is easy to use and maintain.
number 15 with more advanced manufactured materials, such as boron carbide, silicon carbide, and fused aluminum, filling in the 10 to 15 rankings. Steel abrasive hardness is measured on the Rockwell “C” scale (designated by “R”). Commonly used steel abrasives range from soft R-40 to hard R-66.

Logically, harder abrasives perform better on difficult cleaning jobs, whereas soft abrasive is more suitable for delicate blasting. Generally, garnet has a hardness of 7 to 8 and aluminum oxide is 9. On the soft end, agricultural abrasives are around 3 and plastic media range from 3 to 4.

Friability refers to the breakdown factor of abrasive, which determines the number of reuses. Friability is a result of the product’s composition, hardness, and brittleness. Generally, most manufactured and byproduct abrasives have some reuse advantages. Some natural abrasives, such as garnet and flint, can be recycled, but silica sand absolutely can never be reused. Silica sand has an extremely high friability rating due to its quartz composition. It can only be used once because it pulverizes by 70 to 80% at 100 psi (690 kPa) on the first cycle. Recycling silica sand simply is not a good practice, especially in light of the increased health hazards from microscopic dust particles. Highly durable steel grit may be effectively recycled as many as 200 times. It is difficult to list reuse numbers for each abrasive because there are several variables, such as air pressure and surface hardness, that affect breakdown. Check with abrasive suppliers for accurate reuse factors.

COMMON ABRASIVE CATEGORIES

Abrasives is classified in three major categories - natural, by-product and manufactured. Each of these categories is discussed below.

Natural abrasive is material that was created by Mother Earth. In this category are silica sand, mineral sand, flint, garnet, zircon, and similar local mineral products. All of these abrasives have good cutting qualities and are relatively economical to use. With the exception of garnet, these abrasives are not recommended for use in an enclosed blasting system due to their rapid breakdown and, on some materials, their high composition of hazardous silica.

Garnet is an extremely hard and sharp blasting media found in specific deposits. It is well suited for tough cleaning applications that require removal of heavy surface materials and high profile texturing. Physical characteristics allow limited reuse advantages. Bulk density of garnet is around 140 lb/ft³ (2.1 kg/L).

The byproduct classification includes agricultural products, which are disposable materials generated from another process, but prove to be highly effective as blast cleaning agents.

There are several types of agricultural media on the market. Two of the most popular are walnut shell and corn cob. Agricultural media, which are lightweight (40+ lb/ft³ (0.6 kg/L)) and soft (Mohs scale of 3), are suitable for applications where paint and other substances are to be removed without affecting the underlying surface. Used properly, their soft, resilient composition will not etch metal or other hard surfaces. As an example, these media are utilized extensively on electric motor cleaning where damage to stator lamination and wire insulation is to be avoided. Other common operations are paint stripping of wood, plastics, and light gauge metals.

The manufactured abrasive category has a variety of metal and nonmetal compositions, and physical features. Typically, metal abrasives are steel and iron; nonmetals are aluminum oxide, silicon carbide, plastic, wheat starch, and glass bead. Although there is some overlap in applications, each type of manufactured abrasive plays a specialized role.

ABRASIVE DESCRIPTIONS

Due to precise surface finishing requirements in the automotive and aircraft industries, metal abrasive development and utilization has become a controlled science. Primary usage for metal abrasive was only in airless centrifugal wheel blast machines where a bombardment with a high volume of cleaning particles on steel substrate required heavy, long-lasting blasting media. Recent advancements in abrasive recovery and cleaning systems have greatly increased the scope of applications where a metal abrasive can be used for environmentally acceptable, economical, high-production air blast applications.

There are three main metal abrasive types - steel, malleable iron, and chilled cast iron. Each type is manufactured in two shapes - round shot and angular grit. Of the three types, steel is by far the most widely used abrasive because of its unexcelled reuse factor. There are claims of steel being recycled 200 times and more. Chilled cast iron may be reused about 50 to 100 times and malleable iron slightly longer than chilled iron. Economies of recycling clearly favor steel abrasive, but selection of the type of metal abrasive is predicated on several application factors.

Steel hardness ranges from 35 to 65 R; malleable iron from 28 to 40 R; and chilled iron from 57 to 68 R. As with all other abrasives, surface condition and desired finish determine the hardness necessary to do the work.

Chilled iron and malleable iron are less expensive than steel and are used where blasting installations experience a heavy loss of abrasive in the process of loading and unloading parts. Additionally, iron is more brittle and tends to break down into angular particles, making it more aggressive than steel.

Steel particles deform on impact rather than shatter, like iron, into smaller pieces. Steel abrasive actually wears away until the particles become too small to be usable. Due to the long life of steel, new abrasive must be continually added to maintain a consistent blast pattern. Larger particles impact the surface with more kinetic force than small particles; therefore, it is necessary to establish an operating mix and monitor the amount of small, medium and large particles to ensure that the desired surface finish does not change.

Metal abrasive sizing is standardized to the Society of Automotive Engineers (SAE) specifications. Grit sizes are designated G-10 (2.0/1.7mm) to G-120 (0.125/0.075mm), with G-10 being the largest. Shot sizes range from S-70 (0.125/0.180mm) to S-780 (1.7/2.0mm), with S-780 being the largest size. Grit is semiangular and provides valley and peak profiles. Shot, being round, produces a dimpled effect on a surface, often referred to as “shot peening”.

Shot peening is a carefully controlled process where parts subject to stress fatigue can be strengthened by peening. The impact of round pellets at high velocity imparts a compressed layer over the surface. The compression layer actually diffuses stress forces across a larger area of the part, resulting in a stronger, longer-life part. Shot peening is a vital process in many industries, such as
automotive, aircraft, and gears. Shot is also widely used for cleaning castings and forgings, and in many airless blast machines to remove mill scale from new steel plate, pipe and other steel substrate.

Silicon carbide is the hardest, sharpest, most expensive abrasive on the market. It is used for unique applications where optimum abrasion is required. These media measure 9 on the Mohs scale (original) and are close to the hardness of diamond. One primary use of this abrasive is removing heat-treat residue from hardened parts. There are various special surface finish applications where a fine but deep cutting abrasive is necessary.

Aluminum oxide, which rates second only to silicon carbide in sharpness, is the popular choice for super tough cleaning jobs. Its cost dictates that these media be utilized in enclosed blasting systems that recover and filter abrasive. With a density of 120 lb/ft³ (1.8 kg/L) and hardness of 8 on the original Mohs scale, aluminum oxide is the most aggressive, high volume abrasive in the blasting industry.

There are several purity grades available to accommodate specifications that require minimal amounts of contamination. Aerospace and aircraft industries use aluminum oxide for cleaning and deburring on titanium, magnesium, and other sophisticated metals where ferrous contamination must be prevented. Standard grades are used on aluminum, brass, iron, and steel castings to remove flashing quickly while cleaning the surface. Often, other abrasives are mixed with aluminum oxide to obtain blended matte finishes with deep cutting action.

Aluminum oxide is offered in a wide range of sizes from fine to extra coarse. It can be recycled several times depending on whether it is used in suction or pressure blast systems. Users will experience accelerated wear on equipment components that come in contact with the media at high velocity. When blasting with aluminum oxide, nozzles lined with boron carbide are recommended to extend nozzle wear life. Interior rubber lining on blasting enclosures is also encouraged.

Glass bead is a unique abrasive media developed to remove surface contaminants without affecting dimensional tolerances; to provide a polished finish; and in some cases, to shot peen for stress relief. Glass bead is manufactured from lead-free, soda-lime-type glass and contains no free silica. Its shape is almost perfectly spherical, making it ideal media for shot peening uniformly. Its relative hardness of Mohs scale 6 and glass composition cause a high degree of friability; however, using lower nozzle air pressures will prolong the useful life of the media. Typically, air pressure settings for glass bead in suction systems are 70-80 psi (483-552 kPa), and 40-60 psi (276-414 kPa) in pressure systems. Excessive pressures destroy glass bead prematurely and do not increase productivity to any reasonable extent.

Glass bead sizes range from US standard mesh screen 12/14 (1.68/1.41mm) to 170/325 (0.088/0.044mm) (US Federal Specification MIL-G9954A: Size 1 to Size 13). Identical surface finish can be consistently accomplished by maintaining an operating mix of bead sizes. As bead breaks down, new bead must be added based on a predetermined blast cycle.

There are countless uses for glass bead. Chief industries are automotive, aircraft, and die casting where it is critical to maintain dimensional integrity of the pieces being processed. Glass bead's high purity prevents contamination on stainless steel, aluminum, and other soft metal materials. It is especially effective in deburring, deflashing, heat-treat scale removal, blending of tools marks and producing an aesthetic appearance on all types of metal. Shot peening with glass bead is an excellent method to reduce crack corrosion failure and provides tension relief on products that are subject to high operational stress.

Crushed plastic and wheat starch are newer blasting media on the market. They are gaining popularity in applications where paint and corrosive material must be removed without disturbing the base substrate. Being angular and resilient, they have proven to be effective in removing unwanted substance from light gauge metal and high-tech composite material without causing damage. The advent of these media has opened up a market that previously would never have been considered in the abrasive blasting process.

Potential uses of plastic and wheat starch can be found in paint stripping of many light gauge metals, fiberglass, various advanced composite materials, and even some wood products. These media are widely used on trucks, buses, automobiles, planes, and boats. They are also used in the electronics industry for flashing removal from sensitive circuitry parts. Due to their ability to remove only surface materials, they are ideal for mold cleaning and precision electronic deburring. A comparison chart of different media is shown below.

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### ABRASIVE COMPARISON CHART

<table>
<thead>
<tr>
<th>Material</th>
<th>Mesh Size</th>
<th>Shape</th>
<th>Density, lb/ft³</th>
<th>Mohs</th>
<th>Friability</th>
<th>Initial Cost</th>
<th>No. of Cycles</th>
<th>Per Use Cost</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica Sand</td>
<td>6-270</td>
<td></td>
<td>100</td>
<td>5.0-6.0</td>
<td>High</td>
<td>Low</td>
<td>1</td>
<td>Med</td>
<td>Nat</td>
</tr>
<tr>
<td>Mineral Slag</td>
<td>8-80</td>
<td></td>
<td>85-112</td>
<td>7.0-7.5</td>
<td>High</td>
<td>Med</td>
<td>1-2</td>
<td>Med</td>
<td>Bp</td>
</tr>
<tr>
<td>Steel Grit</td>
<td>10-325</td>
<td></td>
<td>230</td>
<td>8.0</td>
<td>Low</td>
<td>High</td>
<td>200+</td>
<td>Med</td>
<td>Mig</td>
</tr>
<tr>
<td>Steel Shot</td>
<td>8-200</td>
<td></td>
<td>280</td>
<td>8.0</td>
<td>Low</td>
<td>High</td>
<td>200+</td>
<td>Low</td>
<td>Mig</td>
</tr>
<tr>
<td>Alum Oxide</td>
<td>12-325</td>
<td></td>
<td>125</td>
<td>8.0-9.0+</td>
<td>Med</td>
<td>High</td>
<td>6-8</td>
<td>Med</td>
<td>Mig</td>
</tr>
<tr>
<td>Glass Bead</td>
<td>10-400</td>
<td></td>
<td>85-90</td>
<td>5.5</td>
<td>Med</td>
<td>Med</td>
<td>8-10</td>
<td>Low</td>
<td>Mig</td>
</tr>
<tr>
<td>Plastic</td>
<td>12-80</td>
<td></td>
<td>45-60</td>
<td>3.6-4.0</td>
<td>Low/Med</td>
<td>High</td>
<td>8-10</td>
<td>Med</td>
<td>Mig</td>
</tr>
<tr>
<td>Wheat Starch</td>
<td>12-50</td>
<td></td>
<td>90</td>
<td>2.8-3.0</td>
<td>High</td>
<td>High</td>
<td>10-12</td>
<td>High</td>
<td>Bp</td>
</tr>
<tr>
<td>Corn Cob</td>
<td>8-40</td>
<td></td>
<td>35-45</td>
<td>2.0-4.5</td>
<td>Med</td>
<td>Low</td>
<td>4-5</td>
<td>Low</td>
<td>Bp</td>
</tr>
</tbody>
</table>

- = angular, * = spherical, Nat = natural, Bp = byproduct, Mig = manufactured

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