



## Technical Information

### Abrasive Selection

Abrasive blasting is a very simple process which can be described as “Propulsion of abrasive particles against a surface, usually using compressed air as the energy source.” In actuality, there are many variables which play a major part of the process. Let’s start with the surface to be blasted. It can range from the high tensile steel hull of a nuclear submarine to the back of a gold watch. Obviously, the equipment, the process and the abrasives will vary significantly. This paper will describe many commonly used abrasives, their characteristics and their purpose.

*Please note that Silica Sand is not included as a blasting abrasive. It is a known carcinogen and is rarely used today. Most manufacturers of blasting equipment weld a plate on their machines warning of the dangers of blasting with Silica Sand.*

#### Abrasives are described by four main criteria:

- 1. Abrasives:** Abrasives are sized by “Sieve size”, meaning they will pass through a screen of a given size. A #16 sieve will have 16 “holes” per inch, or particles roughly 1/16 of an inch. Think of sandpaper grit sizes as an example. #80 is coarse, #400 is fine.
- 2. Hardness:** based on Mohs scale of 1-10. 1 being talc, 10 being diamond. Glass is +- 6 on the Mohs scale. Hardness determines cutting ability. Example: You could not cut a steel pipe with a plastic saw. Abrasive must be harder than the surface to be abraded or removed.
- 3. Shape:** Shape can be from spherical to angular. Spherical (round) abrasives work by peening the surface, while angular abrasives cut into the surface, displacing some of the surface material, leaving pits, described as profile. Profile is measured as the difference from the bottom of the pits to the top of the displaced material. Picture dropping a stone into mud. The stone makes a pit, the mud forms a mound around the pit. Profile is desired when coatings are to be applied
- 4. Friability:** This is a fancy word which described a material’s tendency to break upon impact. Imagine throwing a dried mud ball at a brick wall. The mud ball will disintegrate into powder and have no effect on the wall. Abrasives with low friability can be recycled and reused.

#### The following is a list of abrasives, an overview of their characteristics and their common uses.

- 1. Aluminum Oxide:** Frequently referred to as ALOX. This is a manufactured “fused” abrasive, available in either white or brown, and available from “Flour” of +- 3000 sieve to #8 sieve. The most common sizes used for blasting are between #16 and #240. Low friability, Mohs 7-8, used for etching and frosting glass in blast cabinets which recycle, ALOX will produce profile on most high tensile steels. Low imbedment rate. Angular particle shape. fast cutting, sharp profile low dusting. Creates static charge on surface, making dust removal slightly difficult
- 2. Bicarbonate of Soda:** Also known as “soda” or “Bicarb” Soda blasting is used for paint removal, used either wet or dry. A fine white powder, soda is not rated by sieve size. High friability, rarely recycled, Mohs hardness 2-3, highly alkaline, dusty when used dry, will quickly corrode copper or brass. Soda will etch plastic, will not profile steel or pit glass or chrome. Frequently used by automobile restorers for paint removal.
- 3. Copper Slag:** Byproduct of the smelting of copper ore, most popular brand is KleenBlast. Similar to coal slag which is popular in eastern states which is frequently referred to by one of the trade names “Black Beauty”. Shiny black abrasive, available in sieve sizes #8 - #60. Most common size is 16/30. Common low cost abrasive used in general construction and shipyards. This abrasive is commonly used once. Cost of recycling in many cases exceeds the cost of the material. Mohs hardness 6.5 – 7; Moderate dusting., moderate friability, very angular, imbeds in steel or aluminum. Produces profile in mild steel.
- 4. Plastic:** Plastic media was first used in the aircraft industry for stripping paint from aircraft. Plastic media will not remove anodizing or Alodine treatment on aluminum. The most common plastic media are made from acrylic, melamine, urea plastic, polycarbonate and nylon. They range in hardness from Mohs 2.5 - 4 and come in a variety of sieve sizes. The most common used for aircraft parts and automotive paint stripping is Type V. The material is recycled by air washing, sifting and passing over magnets to remove paint and metal particles. Sharp edges wear after reuse.
- 5. Garnet:** The popularity of garnet has increased in recent years. Garnet is a granular form of the same material in the garnet gemstone. The color ranges from pink to purple and is available in a range of sieve sizes from #16 - #3000. It has a Mohs hardness of 7 – 8, fast cutting, high bulk density, sub-angular particle shape, low friability, low dusting, recyclable.. Due to high density, garnet generally cuts faster than copper slag, with lower consumption rates. Garnet does not embed in mild steel or aluminum. It is popular for use in blasting cabinets for paint and rust removal. Garnet is also used in water-jet cutting equipment.
- 6. Glass Bead:** Glass bead is generally used in blast cabinets for surface finishing of non ferrous parts such as brass valves or aluminum castings. It is not an ideal abrasive for paint removal, or preparation for repainting, since it works by peening, rather than cutting. Size designations are not by sieve size, but usually numeric or alpha designations. Mil specs use Numbers from 1-6, Most commonly used are Ballotini sizes from A to AH, with A being the coarsest. Charts are available which compare the various designations to sieve size in inches and microns. Glass beads are almost perfectly spherical and are used for stress relieving of small parts or to impart a semi polished “Sheen” on parts blasted. A new welding torch is a good example of the finish produced by AF glass bead.
- 7. Staurolite:** Most common brand is DuPont StarBlast. This is a 70/140 mesh material which is a byproduct of the refining of titanium dioxide, brown in color, containing <1 – 5% silica. there are a few grades, and one which is guaranteed to be less than 1% silica. It is rounded to sub-angular, has a Mohs hardness of 7, low friability, high bulk density. It is frequently used to blast Corten steel, fiberglass and aluminum. It has a low imbedment rate when used on aluminum.
- 8. Silicon Carbide:** The hardest abrasive short of diamond, at 9 on the Mohs scale. Used for glass etching, profiling hard steels, other applications where a hard sharp, recyclable abrasive is desired. Low friability, sharp angular edges, low dusting, fast cutting with low embedment. This is the most costly abrasive available next to diamond, and is always used in recycling equipment such as blast cabinets. Silicon carbide is very aggressive and wears nozzles and interior cabinet panels at a high rate.



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**9. Steel Grit and Shot:** Made from recycled steel scrap in exact proportions and hardness. Shot is generally round, grit is very angular with sharp edges. Steel shot is used in shot peening operations to stress relieve steel castings, forgings and weldments. They are also used in portable shotblasters to blast concrete decks and steel ship decks. It is also used in fixed "wheel machines" to blast new or old steel beams and plates to remove rust and mill scale. Also used on iron castings to remove casting sand and mold residue. Wheel machines work by dropping controlled amounts of shot into a fast moving wheel which throws the shot at the surface to be cleaned. Very high bulk density, rusts easily when stored, low friability, excellent recyclability, very low dusting. Hardness rated on Rockwell scale, rather than Mohs scale.

**10. Walnut shell:** Also similar are corn cob, pecan shell, etc. Referred to as organic abrasives, they are used for polishing, deburring or deflashing of castings and plastic parts. Mohs scale of 2-3.5. Organic abrasives are used to remove paint from sensitive surfaces such as thin metal and anodized aluminum aircraft parts. Also used on automotive engine parts or machined surfaces.

**Additional Comments:** Other abrasives which will not be covered here include abrasive impregnated sponge, coated abrasives, one of which is zinc coated silica, used for blasting steel such as ship hulls under water, and a variety of other manufactures abrasives. Virtually any granular material that can be propelled through a nozzle can be used as a blasting or polishing abrasive. These include fly ash, Portland cement, crushed recycled glass and a few more obscure.

The results produced by any abrasive are dependent on type of equipment, air pressure, angle of attack (angle of nozzle to surface), Operator skill, condition of surface and coatings to be removed. Coatings manufacturers frequently recommend a certain degree of cleanliness and surface profile required for proper coating adhesion. Other considerations in abrasive selection include local availability, initial cost of abrasive, method and cost of disposal and other health, safety and environmental issues.

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