

BASICS OF COATED ABRASIVES

Coated abrasives consist of the following components:

Abrasive *grain* attached to some sort of *backing material* held on with some type of *bonding agent*.

We'll start by taking each of these components; grain, backing & bonding - and breaking them down into their components. We'll begin with the grains.

GRAIN

There are 4 common types of grains in regular coated abrasives.

Aluminium Oxide – AO is formed by combining bauxite and other materials by firing them in an electric furnace. The resultant mass is then crushed, and the pieces sifted through successively finer screens to assign a grit size (CAMI grading). When crushed, the resulting pieces are naturally pyramidal in shape. Due to the shape and the strength of the materials used in it's making, AO is a very durable grain. The grain is worn down during use, sanding finer the longer it's used. So theoretically, you can start at 80 grit, and after you've worked the abrasive for a while, you'll be sanding more like 100 or 120 grit. Users take advantage of this characteristic by using the belts on more than one machine or application. For instance if you have two wide belt machines doing intermediate and finish sanding respectively, you may use a 120 belt on the first machine to do your intermediate sanding, and when the cut for that application is no longer as sharp, the belt can be moved to the 150 grit machine and used there till the cut for that application is no longer sufficient. This ensures you get the most production and the full value for the belt you purchased.

AO is very tough and durable, as stated above, and is used on bare wood, most metals (especially the steels), leather and a wide variety of other materials. It is a great general purposes grain and probably the most, common grain seen today.

Silicon Carbide – SC is made by combining pure white silica sand and coke, a by-product of coal production. Again, these materials are combined by melting in an electric furnace, crushing the results and sifting the particles through screens to get grit grading. SC grains are shaped like icicles with extremely sharp points and narrow grain bodies. It is second only to diamond in hardness; however it is very brittle due to the narrow grain body. Therefore when pressure is applied to the tip of this grain it fractures. This characteristic is referred to as "friability". The benefit of friability is that a sharp edge is always against your work piece providing extremely consistent finishing ability. Because of the lack of grain body strength, which allows this grain to fracture with hand pressure only, the life as compared to AO or the other grains is less. This is why when you see SC it's normally in finishing type operations where the pressure required for working is lower than it would be in removal grits. Examples of materials normally sanded or ground with SC would include glass, plastic, rubber, paint varnish, lacquer & sealers. It may occasionally be seen in sanding on extremely soft woods like Ponderosa Pine, but we would recommend open coat AO instead as the life would be much better.

Alumina Zirconia – AZ is a grain that takes the best characteristics of AO & SC and combines them together to create one very durable yet friable grain. Its main ingredient is bauxite, just like AO. It is friable like SC but machine pressure is required to crack the AZ grain where the SC grain will fracture under simple hand pressure. Failure to achieve sufficient pressure to crack the AZ grain will result in glazing of the abrasive and reduced life. The best of both worlds, this grain provides you with a consistently sharp edge on the work piece and extended life. It is commonly seen anywhere high removal rates and times are factors, including planing of wood, heavy grinding of metal and other dimensioning type applications. It is normally mounted on heavier paper or cloth backings and the grain itself is 15% – 40% more expensive to produce, so using it in the removal grits, 24 – 60, is where you will achieve more bang for your buck.

Ceramics – There are several different types of ceramic materials including ceramic AO, ceramic AZ and what is referred to full ratio ceramic. Ceramic is manufactured by combining bauxite, just like regular AO, with other materials in a *chemical* bonding process. This chemical bonding results in raw grain that is very porous and coral-like in appearance. The full ratio would be the strongest, the ceramic AZ would be next in strength and the ceramic AO would fall last. Of course, the higher the pure ceramic content the more expensive the material. Ceramics were created for rough grinding on metal, but have crossed over into lots of other areas where sanding is done. But keep in mind you'll get the most value for your dollar using it in the grits where removal or dimensioning work is being performed and then using regular AO or SC for the more intermediate and finishing grits.

DID YOU KNOW?

Natural grain colours are:

AO – brown, pink, white

SC – black

AZ – blue, blue/gray

Ceramic - white

Abrasive manufacturers can make their product any colour they chose to simply by adding dye to the size coat in the making process. Therefore you should not rely on grain colour to inform you of grain type. Also the addition of stearates and lubricants can make it hard to tell original grain colour. Always choose a grain based on the application and the machinery involved.

BONDING

Every coated abrasive receives two layers of adhesive bonding in the making process. The first layer, referred to as the maker coat, is what actually adheres the grain to the backing. The second layer, referred to as the size coat, is what ties the individual grains together (so that they act as a unit as opposed to acting as individual grains) and provides protection against heat.

In the early days, glue bonds were the only bonding agents available. These glue bonds were animal based products that were not phenolic or thermo-setting in nature. In other words, when they got hot during use, they re-softened. The advantage of this re-softening is that the bonding then acts like a cushion for the grain, which results in softer finishing characteristics. The downside is you lose aggressiveness of cut and life, as the protection for the grain from heat offered by phenolic resins is absent in glue bonds.

With the advent of the synthetic resins, the productivity and life of abrasives were greatly enhanced. Resin bonds are phenolic and therefore, offer the grain excellent protection from heat which in turn extends life. Most of the abrasives in use today are resin bonded. When you do encounter glue bonded items, they usually fall into the "finishing" category of products as that's where the workload is the lightest and the softer scratch most important.

Summation – For every sanding/grinding job you have to do, you should be able to look at these components and their components and come up with the qualities an abrasive will need to possess to help you accomplish the job. From the grain to the backing to the type of bonding, there are reasons, or should be, for each choice you make.

The goal is always to determine what is required and then get it done in the most cost effective manner possible. You'll find there are no real short cuts in sanding. Sure you can skip grits, but you will eventually sand the same amount. If you jump from 80 to 220, you will only buy two grits, but you will use double the 220 you would use AND have the time for the extra sanding required because 220 is not designed to remove an 80 grit scratch. In general, as long as you skip no more than one grit in a sanding sequence, you should not be overworking any of the grits involved. Be aware that just because things may SEEM to save you money on the front side, you will be paying in time or aggravation or some other commodity likely just as valuable as the money itself, on the backside.

Abrasive Grains

Aluminium Oxide - A blocky, hard grain best suited for sanding and grinding of ferrous and non-ferrous metals, wood and solid surface materials.

Silicon Carbide - A sharp, very hard and brittle grain best suited for sanding of glass, plastics, rubber, ceramics, solid surface materials and some non-ferrous metals.

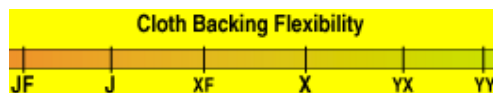
Alumina Zirconia - A very hard and sharp grain that works well for grinding of stainless steel, spring steel, titanium and other hard steels and for dimensioning of wood.

Stearate - An additive that prevents loading when sanding soft resinous woods, after sealer coats and when working with soft ferrous or non-ferrous metals. Not an abrasive grain.

ABRASIVE BACKINGS

Cloth

- J** - A light weight, flexible Egyptian cotton cloth
- JF** - A light weight, very flexible Egyptian cotton cloth
- X** - A heavy, stiff Egyptian cotton cloth
- XF** - A heavy, yet flexible Egyptian cotton cloth
- YX** - A lighter weight polyester backing
- YY** - A very heavy, stiff polyester backing



Fiber - A very hard, strong, coated abrasive backing material consisting of multiple plies of chemically-impregnated paper. Used primarily for disc products.

Paper

- A** - A very light weight paper - typically for sheet use only or light PSA or hook & loop disc usage
- B** - A light weight paper - typically for sheet use only or light PSA or hook & loop disc usage
- C** - A medium weight paper - typically for sheet use only or light PSA or hook & loop disc usage
- D** - A medium to heavy weight paper - typically for sheet use only or PSA or hook & loop disc usage
- E** - A heavy weight paper - typically for stroke or wide belt sanding
- F** - A very heavy weight paper - typically for stroke or wide belt sanding

