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Tips for Selecting Abrasive Wheels

Understanding the basic composition of an abrasive wheel can help you select the wheel that will render the best performance for your application

Timely, efficient grinding operations require proper wheel selection combined with the right tool and an attention to safety.

Abrasive wheels come in a variety of types and sizes, but their basic composition and characteristics are the same whatever their size, shape, or application. Knowing something about abrasive wheel composition can help you select the best grinding wheel for your application.

Abrasive Wheel Composition

Cutting or grinding with an abrasive wheel is just as much a metal cutting process as milling, turning, filing, or sawing. The only difference is the abrasive wheel has thousands of tiny cutting edges instead of the few large ones the other processes possess.

The simple technical description of an abrasive wheel is "a cutting tool consisting of abrasive grains held together by organic or inorganic bonds." Abrasive grains are extremely hard substances such as aluminum oxide, zirconia alumina, and silicon carbide that are embedded in a matrix called the bond. The bond not only holds the abrasive grains together but also allows the mixture to be shaped to the desired wheel form and, after suitable treatment, to take on the necessary mechanical strength for its intended work.

Inorganic bonds include clay, glass, porcelain, sodium, silicate, magnesium oxychloride, and metal. Organic bonds include shellac, rubber, synthetic resin, or resinoid. Resinoid bonds are commonly used to make wheels for metalworking applications.

When cutting with an abrasive wheel, thousands of new cutting edges are exposed as the wheel wears down.

The degree of hardness possessed by the bond is called its grade. Grade also indicates the ability of the bond to hold the abrasive grains in place. A soft bond permits the grains to break away more readily than a hard one and should be used where the abrasive becomes rapidly dulled or blunt, i.e., when grinding hard materials. A hard bond retains the abrasive grains

longer and should be used when grinding soft materials. A simple rule to follow is to use a hard wheel for soft materials and a soft wheel for hard materials.

Remember that the "hardness" or "grade" of a wheel bears no relation to the abrasive material used in its construction. Therefore, a soft grade wheel can be made of the hardest abrasives, and a hard grade wheel can be made of the softest abrasives.

Resin-Bonded Grinding Wheels

The following are things to consider when selecting resin-bonded grinding wheels for your application.

Type of abrasive

Aluminum oxide is made of a clay-like material called bauxite and is reddish brown in color. It is a good choice for use on ferrous metals and alloys with high tensile strength because it offers greater toughness for coping with the greater grinding resistance of these materials.

Zirconia alumina is also suitable for ferrous metals and high-tensile-strength alloys, but it is usually used for higher horsepower or severe applications. Zirconium offers a very sharp, long-lasting grain that results in faster grinding and cutting. While the initial cost is greater than for some other wheels, it can be a more economical choice in the long run for high-volume users because it offers better performance and a longer life cycle.

Silicon carbide is used on nonferrous metals, such as copper, aluminum, and bronze, and low-tensile-strength metals, such as cast iron and ductile iron. It is also the only resin-bonded abrasive used effectively on asphalt, concrete, stone, and marble. Silicon carbide fractures easily, so it provides new cutting edges with minimum wheel wear when grinding these low-resistance materials.

Silicon carbide is greenish black in color and glitters like precious stones, a good point to remember if you ever need to identify a wheel that is missing its label.

Abrasive Grain Size

Use a larger grain for softer materials such as mild steel or green concrete.

Use a smaller grain size for harder steels or cured concretes.

Hardness or Grade

As mentioned previously, hard materials like stainless steel or high- carbon steel are best ground using a softer grade. This allows the dull grains to release more readily so new sharp grains are constantly exposed.

Softer materials won't dull the grains as readily, so a harder grade wheel that will hold the grains in the wheel for a longer period can be used.

Grinding Machine Power

High horsepower machines typically need a harder grade and smaller grain size.

Low horsepower machines typically use a softer grade and larger grain size.

Troubleshooting Abrasive Grinding Wheel Problems

If you're having difficulty with your grinding operations, you might want to consider these common grinding wheel problems and solutions.

Problem 1 - The disc flakes excessively or large sections loosen from the rim.

The disc is being used at a flatter angle than 15 deg. Therefore, the disc wears thin over a greater area of its surface and cannot support itself as designed. The vibration, jarring, and high impact of the grinding action causes fractures in the disc that eventually dislodge.

The disc is being used on a material other than what it was formulated to grind.

Poor operator technique causes excessive impact of the disc to the material.

The disc was chipped during storage, handling, or mounting.

Problem 2 - Slow grinding speed.

The disc is too hard for the material being ground. Consult the manufacturers' application/specification chart to find a softer disc.

Problem 3 - Rapid disc wear (short blade life).

The disc is too soft for the material being ground. Consult the manufacturer's specifications.
Problem 4 - Excessive runout (wobble).

The disc is not properly centered on the grinder flanges. Check the disc seating on the flange step and check for correct flanges.

You may be using the wrong disc arbor for the grinder. Consult the grinder manufacturer's instruction manual for the correct arbor size and match it with the disc arbor.