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(16) Grinding Wheel and Its Binder

STANDARD TYPES OF GRINDING WHEELS

There are various Standard Types of Grinding Wheels, Most Commonly Types are:

STRAIGHT

Straight wheels are commonly applied to internal, cylindrical, horizontal spindle, surface, tool, and offhand grinding and snagging.Type number 1 (1A1) wheels from 0.006-inch to 1/8-inch thick are used for cutting off stock and slotting.

CYLINDER

Cylinder wheels are to be arranged for grinding on either the periphery or side of the wheel.

TAPERED

Tapered wheels take tapered safety flanges to keep pieces from flying if the wheel is broken while snagging.

STRAIGHT CUP(CUPULATE)

The straight cup wheel is used primarily for surface grinding, but can also be used for offhand grinding of flat surfaces. Plain or beveled faces are available.

FLARING CUP(CUPULATE)

The flaring cup wheel is commonly used for tool grinding. With a resinoid bond, it is useful for snagging. Its face may be plain or beveled.

DISH

The chief use of the dish wheel is in tool work. Its thin edge can be inserted into narrow places, and it is convenient for grinding the faces of form-relieved milling cutters and broaches.

SAUCER(DISK-SHAPE)

The saucer wheel is also known as a saw gummer because it is used for sharpening saws.

ABRASIVE MATERIALS

The abrasive grains are the essential took of a grinding wheel. They actually cut small pieces or chips off the work as the wheel rotates. The shape of each grain is irregular with several sharp cutting edges. When these edges grow dull, the forces acting on the wheel tend to fracture the abrasive grains and produce new cutting edges.

ABRASIVES

Most grinding wheels are made of silicon carbide or aluminum oxide, or superhard materials like Diamond or CBN, both of which are artificial (manufactured synthetic) abrasives. Silicon carbide / Diamond is extremely hard but brittle. Aluminum oxide / CBN is slightly softer but is tougher than silicon carbide / Diamond. It dulls more quickly, but it does not fracture easily therefore it is better suited for grinding materials of relatively high tensile strength.

ABRASIVE GRAIN SIZE

Abrasive grains are selected according to the mesh of a sieve through which they are sorted. For example, grain number 40 indicates that the abrasive grain passes through a sieve having approximately 40 meshes to the linear inch. A grinding wheel is designated coarse, medium, or fine according to the size of the individual abrasive grains making up the wheel.

BOND

The abrasive particles in a grinding wheel are held in place by the bonding agent.
The percentage of bond in the wheel determines, to a great extent, the "hardness" or "grade" of the wheel. The greater the percentage and strength of the bond, the harder the grinding wheel will be. "Hard" wheels retain the cutting grains longer, while "soft" wheels release the grains quickly. If a grinding wheel is "too hard" for the job, it will glaze because the bond prevents dulled abrasive particles from being released so new grains can be exposed for cutting.
Besides controlling hardness and holding the abrasive, the bond also provides the proper safety factor at running speed. It holds the wheel together while centrifugal force is trying to tear it apart. The most common bonds used in grinding wheels are vitrified, silicate, shellac, resinoid, and rubber.

VITRIFIED

A vast majority of grinding wheels have a vitrified bond. Vitrified bonded wheels are unaffected by heat or cold and are made in a greater range of hardness than any other bond. They adapt to practically all types of grinding with one notable exception: if the wheel is not thick enough, it does not withstand side pressure as in the case of thin cutoff wheels.

SILICAYE (METALLIC / BRONZE)

Silicate bond releases the abrasive grains more readily than vitrified bond. Silicate bonded wheels are well suited for grinding where heat must be kept to a minimum, such as grinding edged cutting tools. It is not suited for heavy-duty grinding. Thin cutoff wheels are sometimes made with a shellac bond because it provides fast cool cutting.

RESINOID (RESIN)

Resinoid bond is strong and flexible. It is widely used in snagging wheels (for grinding irregularities from rough castings), which operate at 9,500 SFPM. It is also used in cutoff wheels.

RUBBER

In rubber-bonded wheels, pure rubber is mixed with sulfur. It is extremely flexible at operating speeds and permits the manufacture of grinding wheels as thin as 0.006 inch for slitting nibs. Most abrasive cutoff machine wheels have a rubber bond.

ELECTRO-PLATED

The electro-plated binder is adopting of Electro deposition method, to deposite the diamond/CBN powder upto the surface of the substrate (mostly in steel). The merits for such binder is mostly the very good shaping-kept, can achieve to vairous irregular grinding & polishing in irregular surfaces, angles etc.

GRADES OF HARDNESS

The grade of a grinding wheel designates the hardness of the bonded material. A soft wheel is one on which the cutting particles break away rapidly while a hard wheel is one on which the bond successfully opposes this breaking away of the abrasive grain.

Most wheels are graded according to hardness by a letter system. Most manufacturers of grinding abrasive wheels use a letter code ranging from A (very soft) to Z (very hard). Vitrified and silicate bonds usually range from very soft to very hard, shellac and resinoid bonds usually range from very soft to hard, and rubber bonds are limited to the medium

to hard range.

The grade of hardness should be selected as carefully as the grain size. A grinding abrasive wheel that is too soft will wear away too rapidly, the abrasive grain will be discarded from the wheel before its useful life is realized. On the other hand, if the wheel is too hard for the job, the abrasive particles will become dull because the bond will not release the abrasive grain, and the wheel's efficiency will be impaired.

If the grain and bond materials in each of these are alike in size and hardness, the wheel with the wider spacing will be softer than the wheel with the closer grain spacing. Thus, the actual hardness of the grinding wheel is equally dependent on grade of hardness and spacing of the grains or structure.