MACHINING

Q: What is broaching? What type of cut for it (DEPTH OF CUT)? Describe the properties of the broaching products?

-A *broach* .is basically a long multitooth cutting tool that makes successively deeper cuts.

- the total depth of material removed in one stroke of the broach is the sum of the depths of

cut of each tooth

- A broach can remove material as deep as 6 mm in one stroke.
- Broaching can produce parts with good surface finish and dimensional accuracy,
- Although broaches can be expensive, the cost is justified because of their use for high-quantity production runs.

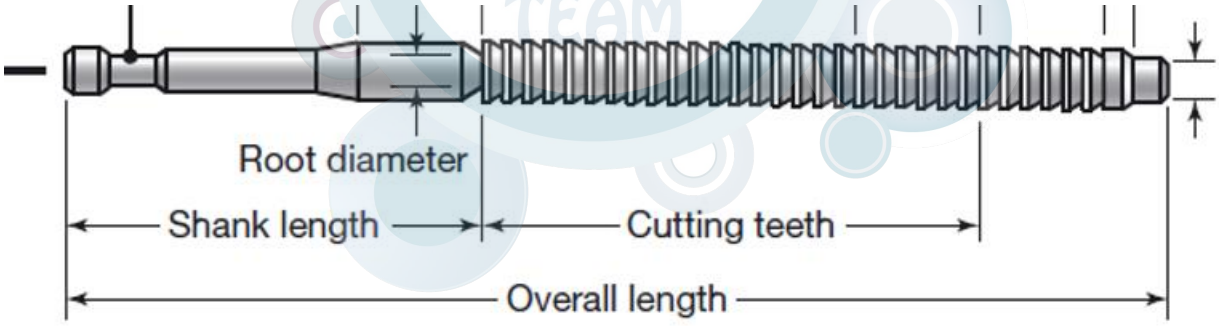
Q: What is the operation that can produce above products in one pass?

broaching

?Q: What is the pitch in broaching tool and why should be of sufficient size?

- The *pitch* of the teeth depends on factors such as length of the workpiece (length of cut), tooth strength, and size and shape of chips. The tooth depth and pitch must be sufficiently large to accommodate the chips produced during broaching, particularly for long workpieces.

Q: Name the three regions in broaching tool in the following figure?



?Q: Name three machining operations for producing gears?

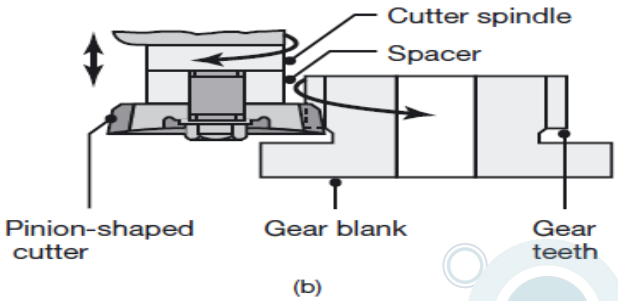
Form, broaching and gear generation

?Q: What is types of gears in most broaching suitable for?

Internal

Q: Name the operation that produces gear in the figure?

Pinion shaped cutter

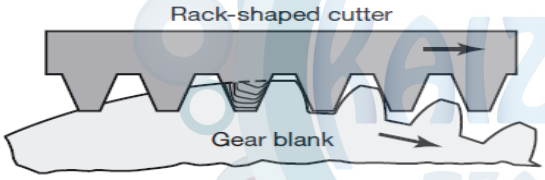


Q: Name three gear generating method for machining?

Pinion-shaped cutter, *Rack-shaped straight cutter, Hob*

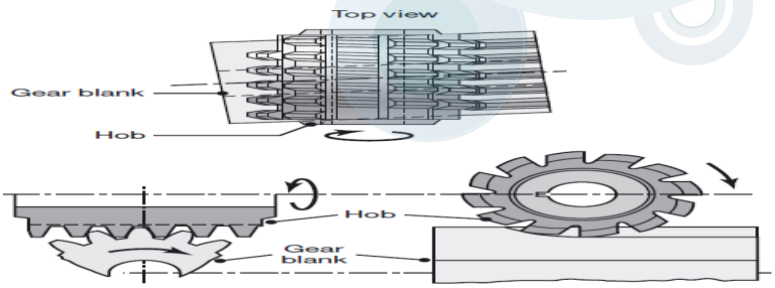
Q: Name the operation that produces gear in the figure?

Rack-shaped straight cutter



Q: Name the operation that produces gear in the figure?

Hob



Q: Problem with previous methods is requiring specialized tooling

<u>Solution</u>

Modern gear-manufacturing machines are all computer controlled, and multiaxis computer-controlled machines have capabilities of machining differenttypes of gears, using indexable cutters.

So we need a program instead of specilised tools

Q: What is a machining center?

It is a computer-controlled machine tool capable of performing a variety of machining operations on different surfaces, locations, and orientations on a workpiece

Q: Name two consequences of poor vibration and chatter?

• Poor surface finish;

• Loss of dimensional accuracy of the workpiece;

• Chipping, excessive wear, and failure of the cutting tool, especially critical for brittle tool materials, such as ceramics, some carbides, and diamond;

• Damage to the machine-tool components from excessive vibrations;

• Noise generated, particularly objectionable if it is of high frequency, such as the squeal in turning brass

Q: Name two causes for forced vibration?

Forced vibration is generally caused by some periodic force present in the machine tool, such as from gear drives, imbalance of the machine components, misalignment, or from motors and pumps.

Forced vibrations may be due to the periodic engagement of the cutting tool with the workpiece, including its entry and exit from the workpiece surface.

Q: Name one method to reduce forced vibration?

The amplitude of vibration can be reduced by increasing the stiffness or the damping of the system.

Although modifying the process parameters generally does not appear to greatly influence forced vibrations, changing the cutting speed and the tool geometry can be helpful.

Q: What is chatter in machining?

self-excited vibration is caused by the interaction of the machining process with the structure of the machine tool;

Q: Name two factors that cause chatter?

cutting forces and the depth and width of cut, chatter generally increases as hardness increases, continuous chips have steady forces and cause less chatter than discontinuous chips

Q: Name two solutions for chatter?

1Increasing the dynamic stiffness of the system;

2 by damping.

?Q: Differentiate between internal and external damper?

1-Internal damping of structural materials: material, joints and structure.

2- External damping. External damping is typically accomplished by using external dampers

Q: In short what causes regenerative chatter?

regenerative chatter, which is caused when a tool cuts along a surface that has a roughness or disturbances left from the previous cut. Because the depth of cut varies due to the surface, the resulting cutting force variations cause tool vibration. The process continues repeatedly during machining, hence the term *regenerative*.

ABRASIVE:

Q: Name two reasons why we need abrasive machining?

1-the workpiece material is either *too hard* or *too brittle*,

2- or its *shape* is difficult to produce with sufficient dimensional accuracy and surface finish by any of the machining methods described previously.

Q: What are the main characteristics of abrasive machining?

Small hard cutting particles with sharp edges, tiny chips

Q: When two use nontraditional machining? In terms of

1-Temperature rise :when temperature rise or residual stresses developed in the workpiece is undesirable or unacceptable**.**

2-part: when the part is too flexible or slender to support the machining or grinding forces, or it is difficult to clamp in workholding devices.

3- shape: when The shape of the part is complex, such as internal and external features or deep small-diameter holes.

4-surface finish and accuracy: when Surface finish and dimensional accuracy requirements are better than those obtainable by other processes.

5-Hardness: when the hardness and strength of the workpiece material is very high, typically above 400 HB.

Q: Name two materials used in

A: Conventional abrasives :

Aluminum oxide (Al2O3); • *Silicon carbide* (SiC).

B: Superabrasives :

Cubic boron nitride (cBN); • *Diamond*

Q: What is the main feature in addition to hardness that affect choice of abrasives:

Friability

Q: What is Friability?

the ability of an abrasive grain to fracture (break down) into smaller fragments.

Q: What kind of characteristic Friable abrasive have?

Self sharpening

Q: Differentiate between fused and unfused alumina(aluminum oxide) in term of

	color	crystallinity	hardness	Friability
Fused	White & dark	*monocrystalline* (single crystal).	Less	White v. v fariable Dark less farible
unfused			harder	

Q: What are the main colors of Aluminum oxide abrasives?

Fused aluminum oxide is *white* (very friable), *dark* (less friable),

Q: purest form of fused alumina?

Seeded gel

Q: Differentiate between green and black silicon carbides?

Green is more friable than black

Q: What are the main colors of silicon carbide?

Green and black

Q: What is the grit number?

A grain size measure

Q: How is the grain size for abrasive expressed?

Grit number

Q: What are the main micro grit sand papers?

Ultra fine\ Super fine \Extra fine \Very fine

What are the main macro grit sand papers?

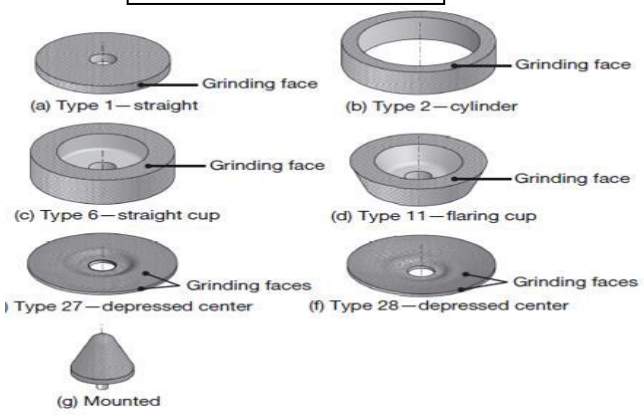
Very fine\ Fine\ Medium Coarse\ Extra coarse

Q: What are the main roles of binders in bonded abrasives?

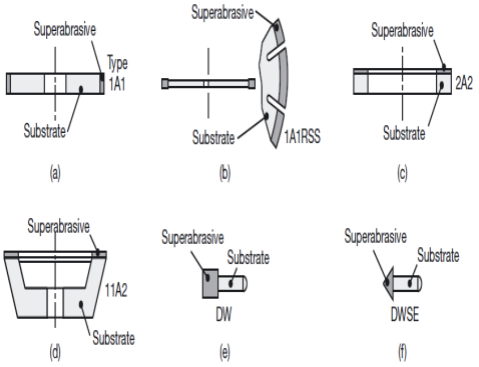
Bondings, support and Porosity maintaining(to provide cooling & clearance for the chips)

Q: Which of the above configuration are for abrasives and which are for super abrasives?

Coventional abrasives



Super abrasives



Q: In the marking for conventional abrasives (alo and sil):

First number is:prefix manufacturer symbo

second:abrasive type

Third:abrasive grain size

Forth :grade

Fifth:structure

Sixth:bond type

Seventh: manufacturer record

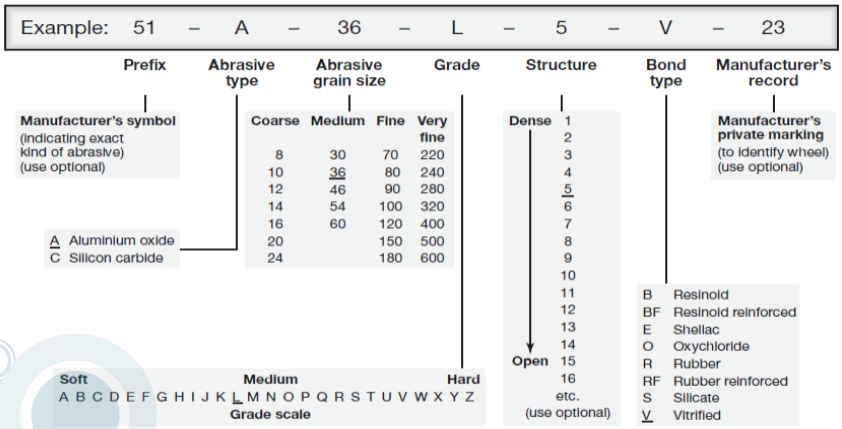


FIGURE 9.4 Standard marking system for aluminum-oxide and silicon-carbide bonded abrasives.

Q: In the marking for super abrasives :

First number is:prefix manu symbol

Second:abrasive type

Third :grit size

Forth: grade

Fifth:diamond concentration

? Sixth:bond

?Seventh:diamond depth

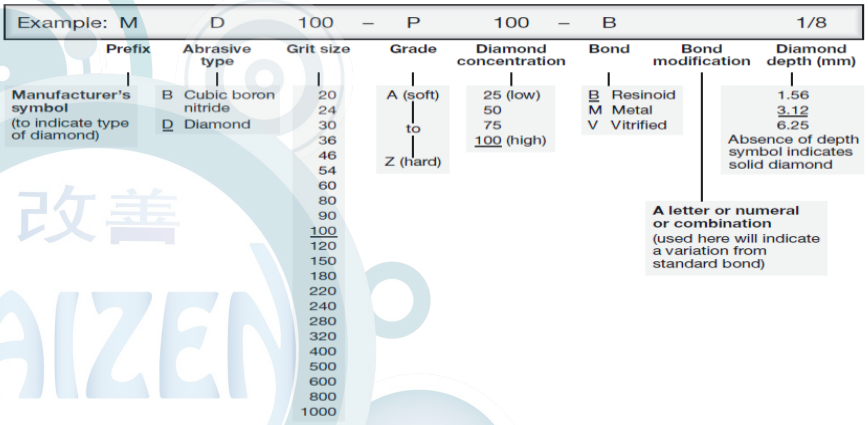


FIGURE 9.5 Standard marking system for diamond and cubic-boron-nitride bonded abrasives.

Q: What is a vitrified bond?

Essentially a glass

Q: What are the characteristics of vitrified ceramics?

Vitrified bonds produce wheels that are strong, stiff, porous, and resistant to oils, acids, and water; however, because the wheels are brittle, they lack resistance to mechanical and thermal shock.

Q: What are the resnoids bonds?

Thermosets

Q: What differentiates resnoids from vitrified?

They are more flexible

Q: What is the most flexible bond in abrasives?

Rubber

Q: Name a usage for rubber bonder abrasives?

Thin wheels for cut-off operations

Q: For which abrasive the metal bond is used?

Diamond or cubic boron nitride

Q: Why is temperaturerise an important consideration?

Temp rise can

(a) adversely affect workpiece surface properties;

(b) cause residual stress;

(c) cause distortion and difficulties in controlling dimensional accuracy;

(d) when high, it can cause burning and structural changes.

Q:How high can the temperature reach in grinding?

1650 C

Q: Why do we have sparks in grinding?

because of the exothermic reaction of the hot chips with oxygen in the atmosphere

Q: Explain how the scanning electron microscopy prove that chips had melted and rapidly solidified?

It shows that these particles are hollow and have a fine dendritic structure,indicating that they were once molten and have resolidified rapidly.

Q: Name four factors affected by grinding temperature?

1-tempering 2-burning 3-heat checking 4-residual stresses

Q: How can temperature affect steel in grinding?

soften the surfaces of steel components;

Q: How can tempering in grinding be avoided?

avoiding excessive temperature rise; grinding fluids

Q:What is the sign of steel burning in grinding?

Bluish color

Q:What is metallurgical burn?

metallurgical transformation, with martensite formation in high-carbon steels from reaustenization

Q: What is the reason for heat checking in grinding?

High temperature leading to thermal stresses

Q:What is heat checking?

Thermal cracking of workpiece surfaces.

Q:What is the main characteristics of the heat checking cracks?

They are perpendicular to the direction of the grinding

Q: What are the main factors that reduce residual stresses in grinding?

Feed rate, and grinding fluid, depth of cut

Q: What is attritious wear?

When the cutting edges of a sharp grain become dull by attrition developing a *wear flat* (and it's similar to flank wear in cutting tools)

?Q:what is wear flat?

?Developed from attritious wear

Q: What causes attritious wear?

by complex physical and chemical reactions between the grain and material.

These reactions involve (a) diffusion; (b) chemical degradation or decomposition of the grains; (c) fracture at a microscopic scale; (d) plastic deformation; and (e) melting**.**

Q: Why is diamond not suitable for grinding steel but cubic boron nitride is?

Because of attritious wear while carbon boron nitride is highly inert to steel thus has lower attritious wear.

Q: In grain fracture why should grain fracture in a moderate rate?

So that new cutting edges are formed.

Q:What happens if the cutting grains become dull?

Inefficient grinding and high temperature.

Q: What happens if the bond is weak?

High wear and low accuracy

Q: What happens if the bond is too strong and does not fracture?

No new cutting edges appear and dull grains don't dislodge

Q: What are the right combination for Hard and soft material in grinding?

Hard-grade wheels are recommended for softer materials, and for removing large amounts of material at high rates (softer bonds are recommended for harder materials, and for reducing residual stresses and thermal damage tothe workpiece.)

Q: What is the operation that restores grinding wheel sharp new grains?

Dressing

Q: When is dressing needed?

In case of attritious wear (glazing) Of posrosity filled (loading)

Q: Why are loaded wheels inefficient?

It generates frictional heat causing surface damage and low accurecy

Q: Name five types of dressing operations?

Cluster, star-shaped steel disks , *Abrasive sticks,* metal-bonded diamond wheels,

electrical-discharge and electrochemical machining, crush dressing

Q: What is the operation in which the round shape of the grinding wheel is restored?

Truing

Q: In an grinding operation 5g of material is removed as compared to 0.01 g of the grinding wheel what is grinding ratio?

$$G = \frac{\text{Volume of material removed}}{\text{Volume of wheel wear}}. \qquad (9.10)$$

=500

Q: the grain force increases with :

(a) strength of the workpiece material; (b) work speed;and (c) depth of cut,

Q: the grain force decreases with increasing :

(a) wheel speed and (b) wheel diameter

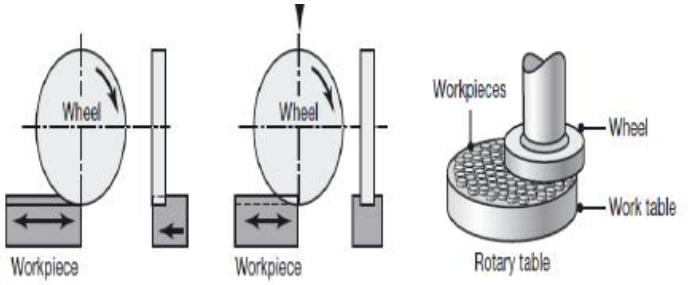
Q:A wheel with softer bond will perform better on:

Hard metal (while hard bond is better on soft metal)

Q: Outline the conditions to grind ceramics within the ductile regime grinding?

Light passes, rigid machine Proper damping

Q: Name the grinding operations in a b , c:(all are surface grinding)



(a) Traverse grinding with a horizontal-spindle surface grinder. (b) Plunge grinding with a horizontal-spindle surface grinder, producing a groove in the workpiece. (c) Vertical-spindle rotary-table grinder (also known as the *Blanchard-type* grinder).

Q:what is the most common grinding operation:

Surface grinding

Q Name and sketch five grinding operations? Sketches?

1-surface grinding (the fig above)

?2-Cylindrical Grinding

3- Internal Grinding

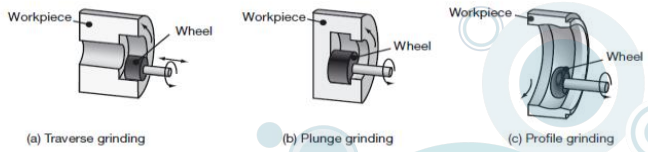


FIGURE 9.16 Schematic illustrations of internal-grinding operations.

4-centerless

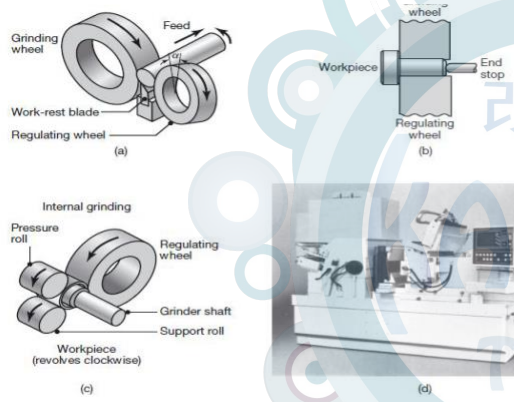


FIGURE 9.17 (a-c) Schematic illustrations of centerless-grinding operations. (d) A computer-numerical-control centerless grinding machine.

5-Creep-Feed Grinding

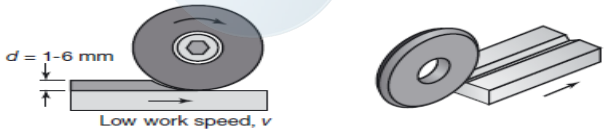


FIGURE 9.18 (a) Schematic illustration of the creep-feed grinding process. Note the large wheel depth of cut. (b) A groove produced on a flat surface in one pass by creep-feed grinding, using a shaped wheel. Groove depth can be on the order of a few mm. *Source:* Courtesy of Blohm, Inc. and Society of Manufacturing Engineers.

Q: What is internal grinding?

a small wheel is used to grind the inside diameter of axisymmetric parts, such as bushings and bearing races.

Q:Name the internal grinding in the figure. A,b,c

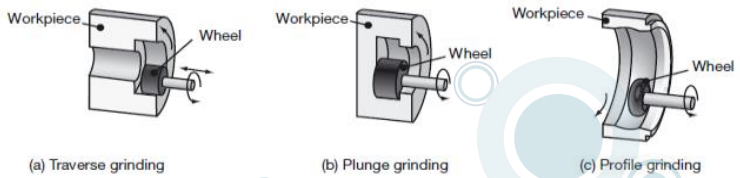


FIGURE 9.16 Schematic illustrations of internal-grinding operations.

Q: Name the grinding operation in the figure?

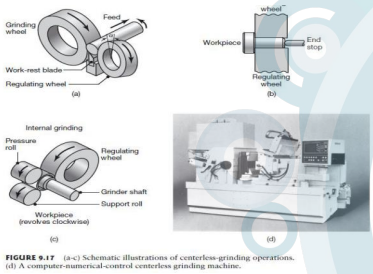
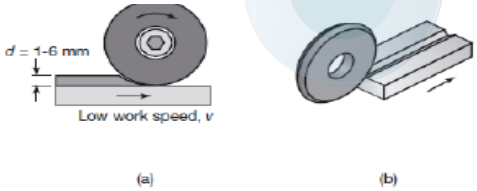


FIGURE 9.17 (a-c) Schematic illustrations of centerless-grinding operations. (d) A computer-numerical-control centerless grinding machine.

Q: What is the grinding operation for a diameter as small as 0.1 mm

Centerless grinding

1Q: What is the name of the grinding operation in the figure?



2Q: Name the efficient grindingoperation with a depth of cut reaching 6 mm in one pass?

Creep feed grinding(ans for 1Q and 2Q)

Q: Name four reasons for chatter in grinding?

Stiffness, non-conformities. Dressing, unever wear

Q: How to solve chatter?

(a) using a soft-grade wheel;

(b) dressing the wheel frequently;

(c) modifying dressing techniques;

(d) reducing the material removal rate; and

(e) supporting the workpiece rigidly.

Q: The use of grinding fluid in grinding?

(a) prevent excessive temperature rise in the workpiece;

(b) improve its surface finish and dimensional accuracy; and

(c) improve the efficiency of the operation by reducing wheel wear, wheel loading, and power consumption

Q: Why do we need specialized nozzles in grinding?

Because of the air stream or air blanket

Q: Why in some cases we need a refrigerating system (chiller)?

Because the in increase in temperature of the fluid, workpiece expand and dimensional accuracy reduce.

Q: Name 11 finishing operation using abrasives?

1. Coated abrasives.
2. Wire brushing.
3. Honing.
4. Electrochemical honing.
5. Lapping.
6. Polishing
7. Laser polishiong
8. Buffing
9. Electropolishing.
10. Chemical-mechanical polishing.
11. Polishing processes using magnetic fields.

Q: Name the finishing operation wusing sandpaper, or emery cloth or belt?

Coated abrasives

Q: What us the finishing operations where the workpiece is held against a circular wire brush rotating at high speed,producing longitudinal scratches on the workpiece surface?

Wire brush

Q: Name the operation in the figures?

Honning

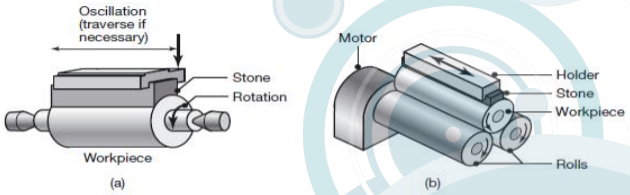
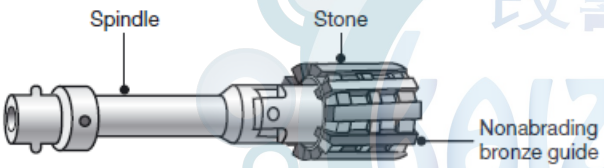


FIGURE 9.21 Schematic illustration of the superfinishing process for a cylindrical part: (a) cylindrical microhoning; and (b) centerless microhoning.



Q: Name the finishing operation using abrasive stones?

honning

Q: How can we achieve superfinishing in honing?

pressure applied is very low, and the motion of the honing stone has a short stroke. The operation is controlled such that the grains do not travel along the same path across the surface of the workpiece.

Q: Why is electrochemical honing used?

as much as 5 times faster than conventional honing, and the tool lasts up to 10 times longer

Q: Name the operation in the figure?

Lapping

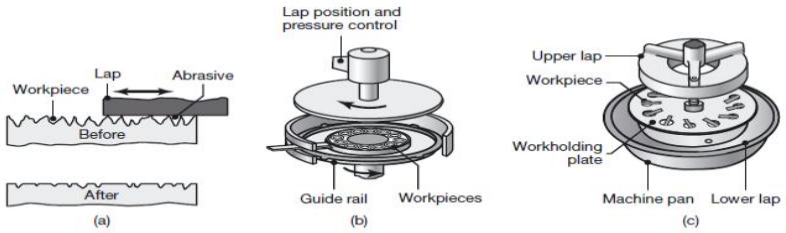


FIGURE 9.22 (a) Schematic illustration of the lapping process. (b) Production lapping on flat surfaces. (c) Production lapping on cylindrical surfaces.

Q: Name the finishing operation that we use fine abrasives on a cloth, slurry leather, cast iron or copper?

lapping

Q: Name the operation with fine-scale abrasive removal and softening and smearing of surface layers by frictional heating?

Polishing

Q:Why do we get mirror surface finish in polishing?

Fine abrasive and smearing

Q: What is the basic principles of laser polishing?

This method involves rapid melting and resolidification of a surface, at depths of submicrons,

using short laser pulses in the range of micro- or nanoseconds

Q: What differentiate buffing from polishing?

This process is similar to polishing, with the exception that very fine abrasives are used on soft disks typically made of cloth.

Q: Why is electro-polishing more suitable for irregular shapes?

No contact with workpiece

Q: What is the basic principle of chemical mechanical polishing?

Controlled corrosion and abrasion

Q: What is operation in the figure?

Chemical mechanical polishing

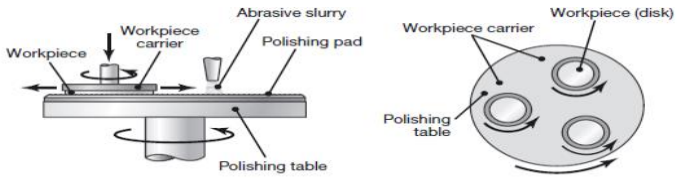


FIGURE 9.23 Schematic illustration of the chemical-mechanical polishing process. This process is widely used in the manufacture of silicon wafers and integrated circuits, where it is known as *chemical-mechanical planarization*. Additional carriers and more disks per carrier also are possible.

Q:What is the process of polishing silicon wafers?

Chemical mechanical polishing

Q: What is the process in the figure?

Polishing processes using magnetic fields.

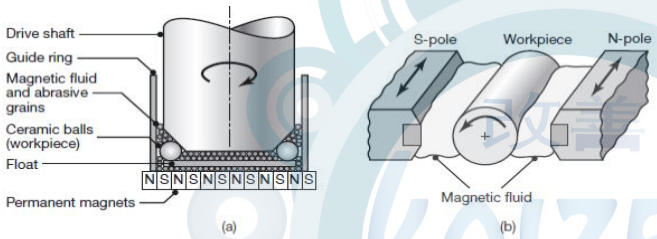


FIGURE 9.24 Schematic illustration of the use of magnetic fields to polish balls and rollers: (a) magnetic float polishing of ceramic balls and (b) magnetic-field-assisted polishing of rollers. *Source:* After R. Komanduri, M. Doc, and M. Fox.

Q: Why is the polishing using magnetic fileds very economical?

It produces fine shapes in a very low time

Q: Why do we get vey fine polishing in magnetic fileds polishing?

The forces applied by the abrasive particles on the balls are extremely small and controllable, hence the polishing action is very fine

Q: What is the magnetic brush in magnetic abrasive finishing?

Similar to a brush a very fine ferromagnetic material conglomerate together with abrasives against the surface of a rotating ceramic roller

Q: What is ribbon in MRF?

A viscoss fluid whose viscosity increases in the prsense of a magnetic fields

Q:Define burrs?

thin ridges, usually triangular in shape, that develop along the edges of a workpiece from processes such as shearing of sheet materials trimming of forgings and castings, and machining operations.

Q: What is the sonotrode in ultrasonic machining?

The tip of the tool, it vibrates at amplitudes of 0.05 to 0.125 mm and at a frequency of 20 kHz.

What is the basic principle of ultrasonic machining?

The vibration, in turn, transmits a high velocity to fine abrasive grains between the tool and the surface of the workpiece.

Q: What is ultrasonic machining best suited for?

Ultrasonic machining is best suited for hard and brittle materials, such as ceramics, carbides, glass, precious stones, and hardened steels.

1Q:How can we reduce contact time?

2Q:Or reduce force?

3Q:Or if we increased for example speed by double how much force is reduced or contact time is reduced.?

Using these equations we get the answers for 1,2,3Q

$$t_o \simeq \frac{5r}{c_o}\left(\frac{c_o}{v}\right)^{1/5}, \qquad (9.11)$$

where r is the radius of a spherical particle, c_o is the elastic wave velocity in the workpiece $\left(c_o = \sqrt{E/\rho}\right)$, and v is the velocity with which the particle strikes the surface. The force, F, of the particle on the surface is obtained from the rate of change of momentum; that is,

$$F = \frac{d(mv)}{dt}, \qquad (9.12)$$

where m is the mass of the particle. The *average force*, F_{ave}, of a particle striking the surface and rebounding is

$$F_{\text{ave}} = \frac{2mv}{t_o}. \qquad (9.13)$$

Q: What is the name of process which can produce the following slots?

&name the parts in the figure:

Ultrasonic machining

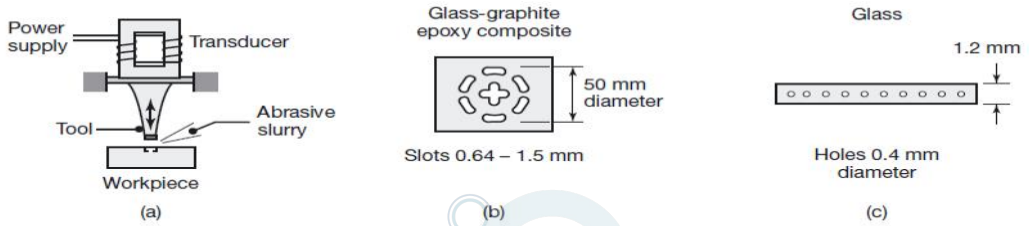


FIGURE 9.25 (a) Schematic illustration of the ultrasonic-machining process; material is removed through microchipping and erosion. (b) and (c) Typical examples of cavities produced by ultrasonic machining. Note the dimensions of cut and the types of workpiece materials.

Q: What is the name of the machining process were we use reagent and etchant for machining?

Chemical machining

?Q: What is the basic principle of chemical machining?

The material is removed from a surface by chemical dissolution, using reagents, or etchants, such as acids and alkaline solutions.

Q: Name the opetration?

Chemical milling

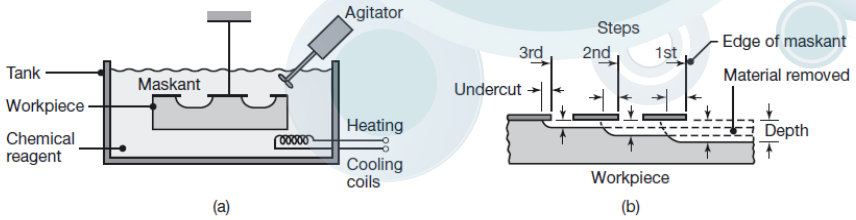


FIGURE 9.27 (a) Schematic illustration of the chemical machining process. Note that no forces are involved in this process. (b) Stages in producing a profiled cavity by chemical machining.

Q: What is the name of the machining in which we use a maskant?

Chemical milling

?Q: What is the maskant?

removable layers controlling chem. milling

Q: What is the basic principle of chemical milling?

Selective attack controlled by the maskant

Q: Provide a usage for chemical milling?

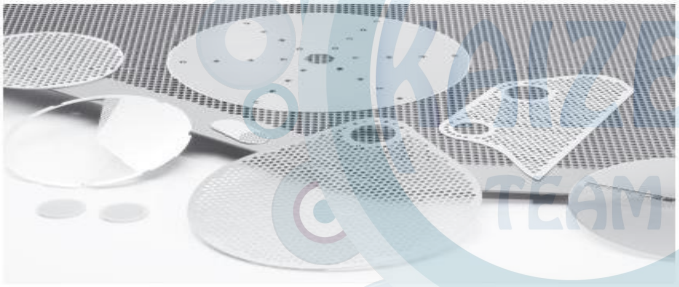
Chemical milling is used in the aerospace industry, particularly for removing shallow layers of material from large aircraft,missile skin panels, and extruded parts for airframes, to fabricate microelectronic devices (wet etching.)

Q:what is wet etching?

Fabricating microelectronic devices

Q: What process is most suited to produce these product?

Photochemical blanking



Q: What is the difference between photochemical blanking and chemical milling?

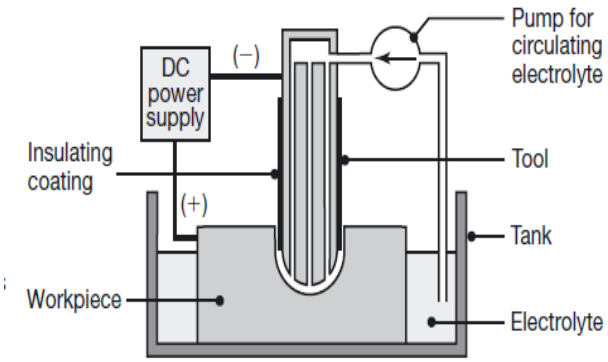
The use of photographic technique.

Q:Give example of products for photoetching?

fine screens, printedcircuit boards, electric-motor laminations, and flat springs

Q: What is the operation in the figure?

Electrochem machining



?**Q: What is the purpose of the electrolyte in electrochemical machining?**

It's a highly conductive inorganic salt solution, such as sodium chloride mixed in water or sodium nitrate, and is pumped at a high rate through the passages in

the tool.

Q: Name the operation in which the electrode is the tool and the high conductive electrolyte is used?

Electrochem machining

Q: Name the process to produce the following parts?

Electrochem machining

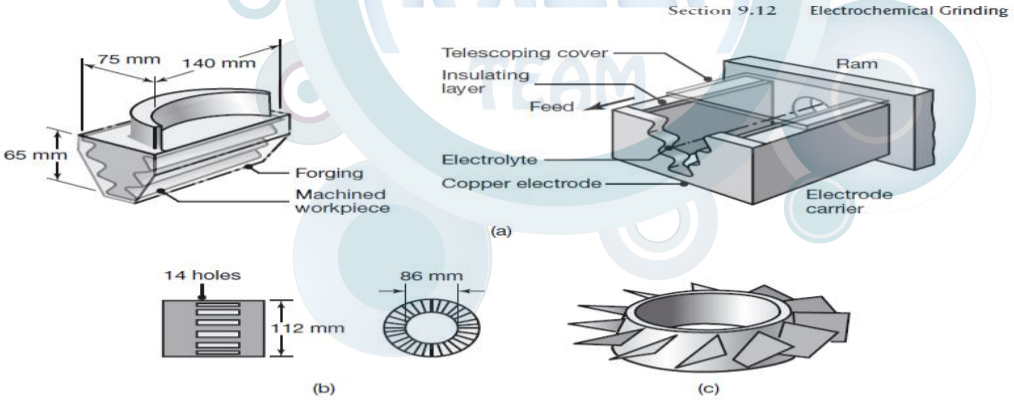


FIGURE 9.31 Typical parts made by electrochemical machining. (a) Turbine blade made of a nickel alloy, 360 HB; the part on the right is the shaped electrode. *Source:* ASM International. (b) Thin slots on a 4340-steel roller-bearing cage. (c) Integral airfoils on a compressor disk.

Q: Why is disk wheel wear is low in ECG?

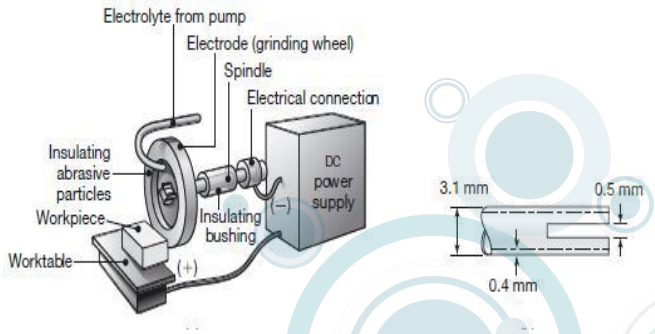
Cause he majority of metal removal in ECG is by electrolytic action, and typically less than 5% of metal is removed by the abrasive action of the wheel

?Q: What is the process in which conventional machining and electrochemical machining?

Electrochemical Grinding

Q: What is the process in the figure?

Electrochemical Grinding



?Q: Give example of products for ECG?

It's successfully applied to carbides and high-strength alloys.

Q: Why is it more efficient than diamond wheel grinding?

when processing very hard materials, for which wheel wear can be high.+ECG machines are available with numerical controls, further improving dimensional accuracy and providing repeatability and increased productivity.

Q: What is the process where we dielectric fluid and the electrode is the tool?

EDM (Electrical-Discharge Machining)

Q: What happens to the dielectric fluid during the EDM procedure?

It's heated rapidly, causing evaporation of the fluid in the arc gap.

++ This evaporation, in turn, increases the electrical resistance of the interface, until the arc can no longer be maintained. Once the arc is interrupted, heat is removed from the gas bubble by the surrounding dielectric fluid, and the bubble collapses (*cavitates*).

Q: Why is the EDM not affected by the strength, toughness or hardness of the material?

Because the process does not involve mechanical energy

Q: What is the common electrode material of the electrode in EDM?

Graphite

++ although brass, copper, or copper-tungsten alloy may be used

Q:how/what is used for no-wear EDM?

by reversing the polarity and using copper tools

Q: Why is EDG used for thin tubes?

No contact forces, material removed by electrochemical action

Q: What is name of the process in which a rotatingwheel spark discharge causes material removal?

EDG

Q: What is the operation in which a slow moving wire travels in a prescribed path cutting the workpiece through sparks?

Wire EDM

?Q: What is the kerf in wire EDM?

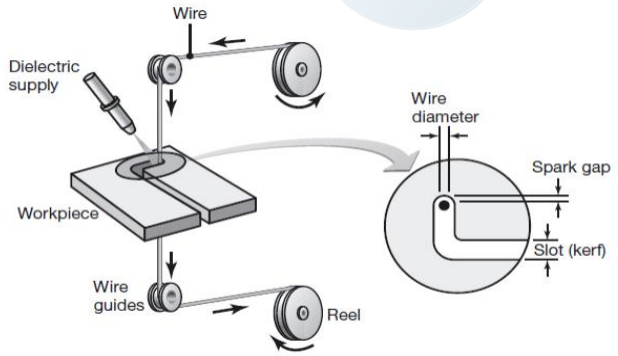
a constant gap that is maintained during the cut in wire EDM

Q: What is the kerf in the figure?

On the fig

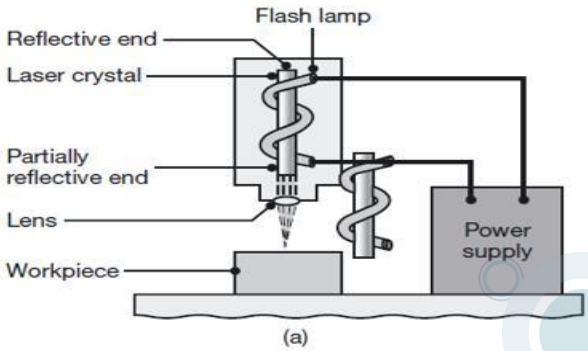
Q: Name the operation?

Wire EDM



Q: Name the operation?

Laser beam machining LBM (type of High-Energy-Beam Machining)



Q: What laser stands for?

an acronym for LightAmplification by Stimulated Emission of Radiation

?Q: What is the basic principle for laser-beam machining

the source of energy is a laser ,which focuses optical energy on the surface of the workpiece .The highly focused, high-density energy melts and evaporates small portions of the workpiece in a controlled manner.

Q: What is the operation in which we can produce holes as small as 0.005 mm in diameter

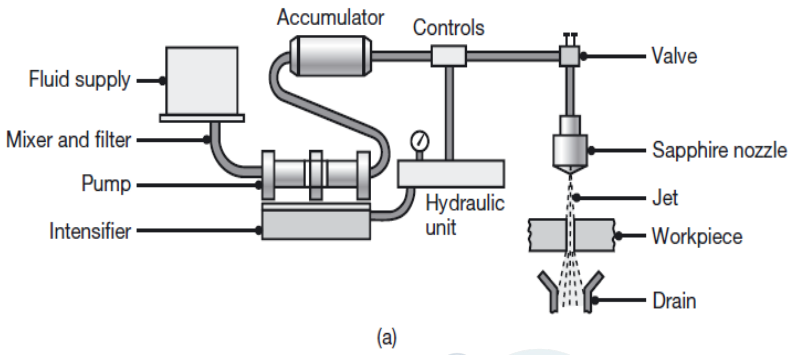
Laser beam machining LBM (type of High-Energy-Beam Machining)

Q: What is the process in which hydrodynamic machining is used for metal cutting?

Water-jet machining (WJM)

Q: Name the procedure in the figure?

Water-jet machining (WJM)



(a)

Q: What materials are cut by water jet?

A variety of nonmetallic materials can be cut with this technique, including plastics, fabrics, rubber, wood products, paper,leather, insulating materials, brick, and composite materials

Q:what type of machining can be used in food processing industry and why?

WJM , Because it is an efficient and clean operation as compared with other cutting processes, for cutting and slicing food products

Q: What materials are cut using AWJM?

Metallic, nonmetallic, and composite materials of various thicknesses can be cut in single or multiple layers, particularly heat-sensitive materials that cannot be machined by processes in which heat is produced

?Q: What is the cutting material in AJM, WJM, AWJM?

AJM: a highvelocity jet of dry air, nitrogen, or carbon dioxide, containing abrasive

particles, is aimed at the workpiece surface under controlled conditions

AWJM: the water-jet contains abrasive particles such as silicon carbide or aluminum

oxide, thus increasing the material removal rate over that of water-jet machining.

?WJM: A water-jet cutting machine and an aluminum alloy part produced

Q: Name applications for AJM?

(a) cutting small holes, slots, and intricate patterns in very hard or brittle metallic and nonmetallic materials;

(b) deburring or removing small flash from parts;

(c) trimming and beveling;

(d) removing oxides and other surface films; and

(e) general cleaning of components with irregular surfaces.

Q: **Name the operation in the figure?**

AJM

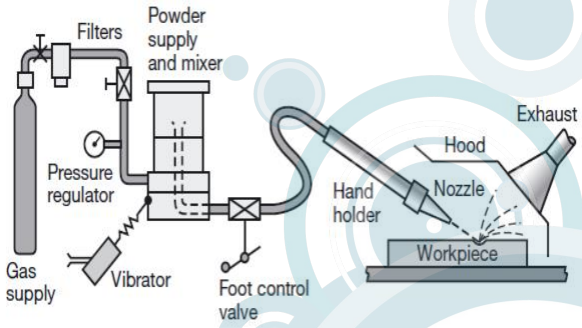


FIGURE 9.41 Schematic illustration of the abrasive-jet machining process.

Teams MCQ :

Q:What is the general term for the manufacturing processes involved in material removal?

a) Forming

b) Machining

c) Casting

d) Welding

e) Sintering

Q:Out of all the machining processes mentioned in the paragraph, which one is NOT one of them?

a) Cutting
b) Abrasive processes
?c) Forming
d) Advanced machining processes
?e) Forgin

Q:Which of the following is an example of a cutting process?

a)Grinding

b) Honing

c) Turning

d) Ultrasonic machining

e) Laser cutting

Q:In which category of machining processes does grinding belong?

a)Cutting

b) Abrasive processes

c) Advanced machining processes

d) Forming

e) Extrusion

Q:What are advanced machining processes sometimes referred to as?

a)Traditional machining processes

b) Non-material removal processes

c) Nontraditional machining processes

d) Basic machining processes

e) Subtractive manufacturing processes

Q:Which energy sources are used in advanced machining processes?

a) Mechanical and hydraulic

b) Electrical, chemical, thermal, hydrodynamic, and optical

c) Pneumatic and sonic

d) Kinetic and potential

e) Magnetic and gravitational

Q:What is the primary purpose of abrasive processes in machining?

a) Shaping the workpiece

b) Joining materials

? c) Removing material through abrasion

d) Applying a protective coating

e) Improving surface finish

Q:Which of the following is an example of an abrasive process?

a)Turning

b) Milling

c) Lapping

d) Broaching

e) Electrochemical machining

Q:What distinguishes advanced machining processes from traditional machining processes?

a) They use only mechanical energy

b) They are faster but less precise

c) They use nontraditional sources of energy

d) They are limited to cutting and forming processes

e) They involve additive manufacturing techniques