

SURFACE FINISH

Q.1. What factors govern the selection of a particular cleaning process for metallic surfaces

Ans. Selection of cleaning process is mainly influenced by

- (a) Type of contaminants
- (b) Degree of cleanliness required
- (c) Composition of metal
- (d) Condition of metal
- (e) Thickness of rust and scale
- (f) Allowable metal loss
- (g) Surface finish tolerances
- (h) Shape and size of workpieces
- (i) Production requirement
- (j) Available equipment
- (k) Cost involved.

Q.2. Describe the process 'Electro-forming' in detail.

Ans. This is the process of forming metals. The parts of various shapes are produced by electrolytic deposition of metal upon a conductive removable mould. The difference between electroplating and electro-forming being that in the former case the metal permanently sticks to the cathode, whereas in later case a solid shell is produced around the cathode which can be separated from it. The cathode (mould) can be made of any shape depending upon the shape required for the part. The finish of part produced depends upon the surface smoothness of mould. The metal for electroforming the part on the mould is supplied from an electrolytic solution in which a bar of pure metal acts as an anode for the plating current.

This process is very useful for thin walled parts where high accuracy and surface finish are desirable. This is also suited to complicated internal shaped parts which are difficult to machine. The process is also very advantageous for production of small number of parts for which other methods will be very expensive.

Process. In electroforming process, first a negative image of part, called matrix, mould or pattern is prepared. This can be either permanent or expendable type depending upon the shape of part to be produced. Permanent moulds can be easily machined from metal and are very economical. These can be used only when there is sufficient draft to withdraw them without any damage to the formed part. The expendable type of cores can be either of low melting temperature alloy or of some chemically soluble substance. In case of expendable type of moulds, the substance used may be nonconducting e.g., plastic etc. In such cases they must be coated with some metallic film by spraying, brushing or chemical reduction. Wax mould can be coated with graphite.

After the desired forms are prepared, the moulds are placed in the electrolytic solution and proper current is passed in the solution. The mould keeps on receiving the metallic ions from the metallic rod and finally a layer of sufficient thickness is formed around the mould. It is then removed from the bath, rinsed and then stripped from the mould. The various metals used for electroforming include copper, nickel, iron, silver, zinc, lead, tin, cadmium, gold, Aluminium and others having conducting nature. Out of these copper, nickel, iron and silver are best suited for electroforming as they have the properties of good reproductibility, resistance to corrosion, good bearing surface and adequate strength for small thickness. The properties of the electroformed parts depend upon the characteristics of the metal used, rate of deposition of metal and plating temperature etc. Some changes in properties of electroformed parts can also be achieved by proper heat treatment.

Q.3. What is 'Abrasive cleaning'?

Ans. This method is widely used for removing all classes of scale and rust from forgings, castings, weldments, and heat treated parts. Depending on the finish requirements, blasting may be the sole means of scale removal or it may be used to remove the major portion of scale, with pickling employed to remove the remainder. In this process the parts are generally cleaned by the use of abrasive particles such as sand, steel grit, or shot, impelled against the surfaces to be cleaned. Some cleaning is performed by means of a high velocity air blast, with the blast directed by hand. In many cases, an airless blast machine that cleans by impact is also used. The abrasive is fed from an overhead storage hopper to the centre of a radially rotating wheel, whereupon the metallic shot or grit is hurled in a controlled stream upon the work to be cleaned. All traces of sand, scale, oxides, and other material are removed right down to the virgin metal, providing an excellent surface for bonding final finishes. The airless blast machine is used for cleaning engine blocks, crankshafts, castings of different shape and size, railroad cars, car wheels, oil and gas pipes, steel strip, and many other purposes.

Q.4. What are 'Anodic Coatings' and what for are they provided?

Ans. It is an oxidising process used for Aluminium and magnesium articles. The article to be anodised is made anode and sulphuric, oxalic and chromic acids are used as an electrolyte. The coating is produced entirely by the oxidising process and not by plating. The coating so

produced is hard but at the same time it is porous enough and hence advantageous from decorative point of view. Such oxide coatings enable organic coatings and dyes to be successfully used on Aluminum article surfaces. Modern Aluminum glasses and pitchers are the examples of this class.

Q.5. Write short notes on

(1) Parkerizing

(2) Tumbling

Ans. (1) Parkerizing : It is a process used for making thin phosphate coatings on steel to act as a base or primer for enamels and paints. In this process steel articles are dipped in a heated solution of magnesium dihydrogen phosphate at temperature of 88°C for about 45 minutes. During the dipping period, the phosphate from magnesium dihydrogen phosphate decompose and phosphate separates out and forms a thin coating on the steel articles.

(2) Tumbling :- Tumbling, often, is the least expensive process for removing rust and scale from metal parts. Parts configuration and size are the primary limitations of the process. Tumbling in dry abrasives (deburring compounds) is effective for removing rust and scale from small parts of simple shape. However, parts of complex shape, with deep recess and other irregularities, cannot be descaled uniformly by tumbling. It may require several hours of tumbling, if the method is used. The addition of descaling compounds instead of deburring compounds will often decrease the tumbling time by 75 percent.

The operation is accomplished by placing work pieces in a drum or barrel, together with stars, jacks, slugs, or abrasive materials. The abrasive materials can be sand, granite chips, slag, or Aluminum oxide pellets. In operation, the barrel is rotated, and the movement of the work pieces and the accompanying slugs or abrasive material against each other produces by friction a fine cutting action which remove the fins, flashes, and scale from the products.

Q.6. What is buffing ?

Ans. Semi-automatic machines are mostly used for doing this jobs. These machines carry a series of polishing and buffing wheels, which can be adjusted to different positions so that all surfaces of the part can either be polished or buffed as required. The compounds and wheels selected are governed by the shape of the part, the material of which it is fabricated, and the appearance of the product. For ordinary polishing and buffing operations, polishing and buffing wheels are mounted on floor polishing lathes.

Commonly used polishing wheels are constructed of

canvas, muslin, felt, and leather, while buffs are flexible wheels made of cotton cloth, canvas, linen, flannel or wool discs.

Polishing and buffing compounds, like wheels, are usually divided in two broad categories : (1) cutting down, the removing of scratches and grain lines from previous operations, and (2) colouring, which gives the product the final, bright, deep luster.

Buffing compounds can either be greaseless or have a grease base. A mixture of glue base, a softening agent, and a mineral make up a greaseless compound. Grease buffing compounds use oil, tallow, and other bonds. Many abrasive elements are used for the colouring compounds, such as red rouge, green rouse, crocus, and white colouring compounds.

Q.7. Highlight the specific difference between Electroplating and Electroforming?

Ans. The difference between electroplating and electroforming being that in electroplating, the metal permanently sticks to the cathode, whereas in a solid shell is produced around the cathode which can be separated from it.

Q.8. Write short note on metal spraying covering mainly the following :-

1) Surface preparation

2) Methods of spraying

Ans: Metal spraying or metallizing literally means to treat with or coat with a metal or metallic compound. Metallizing as a process normally includes the preparation of base material, the spraying on the metal and finally finishing the surface by grinding.

1) Surface preparation : The surface of parent metal is properly prepared as the bond between the sprayed metal parent metal is purely mechanical. The surface is cleaned by blasting with sharp silica sand or angular steel grit. Cylindrical objects are prepared by machining small grooves on the surface followed by rolling over the tops of these grooves with a tool similar to the knurling tool. Both of the methods roughen the surface and provide the necessary interlocking surfaces, so that the plastic material can be easily adhered to the surface.

The molten material is blown with considerable force, which causes the interlocking with surface irregularities. The sprayed metal itself provides a suitable surface for successive coatings and permits the building up a layer of considerable thickness.

2) Methods of spraying : Basically, there are two types of equipments used for metal spraying. One is the metallic-gun which consists of a gas torch with a hole in the centre of

the tip for the wire, a small air turbine and gears to feed in the wire through the tip into the flame as fast as it melts and an air cap around the torch tip and nozzle which supplies a blast of air to atomise the molten metal and deposit in on the prepared surface. In other method, powdered metal is fed from a container through a rubber hose to the spray-gun and out through the centre of the flame, similar to the wire gun. In this case metal is already in the atomised form and hence air needed is just sufficient to deposit the molten metal on the surface being coated.

The applications of both the methods are important in their respective fields. The powder-gun having no turbine or gears, costs less, is lighter to handle and without the blast of atomising air, can be used more effectively to heat the base metal when such heat is needed. On the other hand, metal is less expensive in wire form than in powder form; metal in wire form is more readily available, and more easily handled.

3) Applications in manufacturing :-

(1) *Corrosion-Protection:-* The most extensive use of metal spraying is the application of Aluminium and zinc into iron and steel. Galvanising is frequently accomplished by spraying of 0.125 mm Aluminium on steel and then heating the part to form iron Aluminium compound on the surface.

(2) *Hard and noble surface:-* One big application of metallizing is the application of special metal surface on large masses of less costly metal e.g., a big shaft required to be corrosion resistant need not be made completely of stainless steel. It might be made first of any metal and then metallized with the noble metal. Similarly the metallizing may be applied for abrasion or wear resistance, corrosion protection and electrical or magnetic properties etc. Most of the regular hard surfacing materials are available in powdered form and can be sprayed when thin coatings are prepared.

(3) *Soldering surfaces:-* Sprayed copper is frequently used on non-metallic parts when it is desired to attach parts by soldering. The procedure may also be adopted on hard solder metals such as magnesium, when galvanic corrosion is not a consideration.

(4) *Electrical conductivity:-* Conductive coating of copper and silver can be obtained on poor conductor e.g., by spraying copper on most of carbon brushes for motors and generators for better electrical connection.

(5) *Thermal conductivity:-* Sometimes it is desirable to have surface to carry away heat from hot spots on poor conductors. In this case copper can be sprayed and it has further advantage of perfectly fitting into the nonconducting part and gives best efficiency.

(6) Its other applications are in having decorative films,

reflecting surface and special metal forms.

Q.9. Describe the following processes.

Ans. 1) Anodising:

2) Shot-peening.

Shot-peening has been developed recently to improve the fatigue resistance of metal by setting up compressive stresses in the surface. The process is carried out by blasting or hurling a rain of small shots pneumatically or mechanically at high velocity against the worked surface. Small indentations are produced due to striking of shots, which causes the metal to flow plastically to a depth of few tenths of mm. This process is adopted to remove stress concentrations on parts of irregular shapes or at local areas.

Q.11. What is Anodising? Give its applications.

Q.12. What is pickling? What processes must be carried out before it?

Ans. The most common method of removing unwanted pigmented compounds which are mostly oxides of metal is by acid pickling. Either diluted sulphuric, hydrochloric or phosphoric acid is sprayed on the part, or the part is dipped into a tank, agitated, and then washed and rinsed thoroughly. Muriatic acid can also be used either hot or cold as a pickling solution. Alkaline cleaning of the part should be used first to remove all dirt and oils in order to obtain an even removal of the oxides during the pickling process. Sometimes it is necessary to add pickling inhibitors such as detergents, liquid glycol, ether, etc. to decrease the action of acid upon the metal particularly Aluminium and other non-ferrous metals.

Q.13. What is shot peening? What properties does it impart?

Ans :- Short peening :- It is a mechanical process used to improve the fatigue resistance of metal by setting up compressive stresses in the surface. It is carried out by blasting or hurling of metal shots on to the surface of a component by air pressure or with the help of a wheel revolving at high speed.

This process imparts some important properties to the metal, such as to remove stress concentration on parts of irregular shapes, increases strength and hardness of the surface and also makes it fatigue resistant.

Q.14. Explain the method of parkerising stating its importance.

Ans: Parkerising: Parkerising is nothing but a phosphate coating on metal surfaces. Phosphate coating is provided on metal surface. Phosphatic coating is provided on metal surface to give the metals large durability. This process is mainly used for steel. Thin coating of phosphate on

steels acts as primer or base coat for paints and enamels. Steels is coated by dipping it in hot bath of manganese dihydrogen phosphate at constant maintained temperature of 88°C for about one third hour. A corrosion resistant film on steel is deposited during this process.

Such type of coating is provided on metal surface to make them wear resistant surface, providing a protective coating against the effects of weather and humidity, providing coloured coatings in different shades, providing a premier base for proper adhesive of organic coating. It also reduces friction to the metal.

Q.15. Write note on :

1) **Barrel finishing (tumbling)**(given earlier)

2) **Barrel blasting.**

Q.16. What are the special features of electroforming for which it is preferred in industries?

Ans. This process is very useful for thin walled parts where high accuracy and surface finish are desirable. This is also suited to complicated internal shaped parts which are difficult to machine. The process is also very advantageous for production of small number of parts for which other methods will be very expensive.