

AS LEVEL Section A

FACT FILES

Technology & Design

For first teaching from September 2011

For first award in Summer 2012

Metal Part 2



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Learning Outcomes

Students should be able to:

- Demonstrate an understanding of the main purposes and types of finishes for metals – painting, plastic coating, electroplating, anodising, enamelling and lacquering.



Course Content

Painting

When metal is to be painted, it is essential to prepare the surface correctly. It must be degreased and cleaned using paraffin, before being washed with hot water and detergent. To prevent rusting a primer should be applied, for example a zinc chromate primer is suitable for steel. To further decrease the likelihood of rust, an oil-based undercoat and topcoat should be used.

If the metal is already rusted and the surface has to be refinished, you can remove the rust with wire wool, emery paper or a wire brush. The surface must then be treated with a primer that is specifically formulated for rust, before applying an oil-based topcoat.

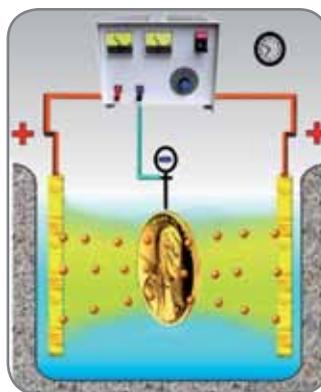
Plastic Coating

Plastic coating is the process of applying a thermoplastic to the surface of metal items to provide long-term corrosion, impact and chemical resistance whilst offering an aesthetically pleasing finish. Plastics can be applied using a thicker protective layer than standard paints and are generally impermeable to water or corrosive chemicals. Plastic coating can be used on most metals and is used for coating metal shopping baskets, tool handles, racks, fittings and suspension coils.



The process involves the degreased and clean metal being heated to approximately 180°C before **fluidisation** (coating process) takes place in a special tank. The metal object is then submerged quickly into the fluidised powder and left for a few seconds, enabling the powder to stick to the metal in the form of a thin coating. The object is then returned to the oven to allow the coating to fuse and leave a smooth glossy coating.

Electroplating



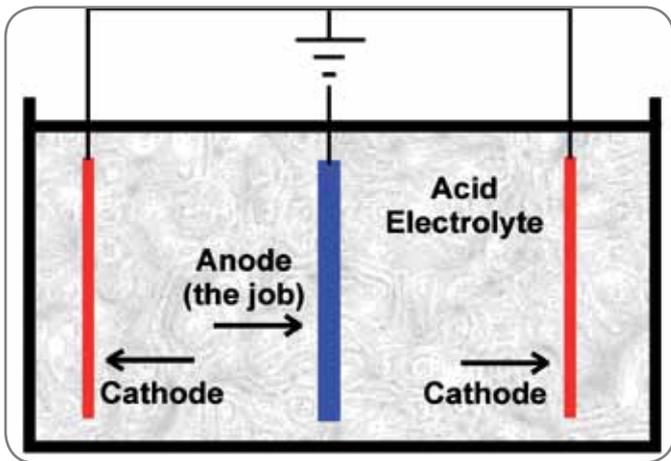
Electroplating is used to provide metals with a more decorative, appealing or protective surface finish. A common example is silver plating.

The metal object is suspended in an electrolyte a solution of the appropriate metallic salt which acts as the conductor. The positive

voltage supply is attached to a metal rod or plate made from the material that is to be deposited on the object.

Successful electroplating requires flat surfaces and avoidance of sharp edges. All corners of the object must be radiused or chamfered and recesses should be avoided.

Anodising



Anodising is a finishing or protective process associated with Aluminium and is used to thicken the natural oxide film on the surface. Anodising is electroplating in reverse. The aluminium is immersed in an electrolyte (solution consisting of an acid/water solution). A range of acids may be used, e.g. sulphuric acid for relatively soft, easily dyed coatings and organic acids for hard coatings. The temperature of the solution is controlled to give the desired properties:

- At 20°C a sulphuric acid anodising solution will give a soft, transparent clear, easily dyed coating.
- At 5°C a hard, dense, dull grey coating is produced (hard anodising).

Enamelling

Enamelling uses powdered glass or minerals which are melted to provide metal with a hard colourful, aesthetically pleasing and protective finish. Enamelling is mainly used to improve aesthetics or to make a product more durable. However, an enamel coating can be prone to damage or chipping by physical knocks or mistreatment.

Vitreous enamelling is used to make products heat resistant and is used for products such as cookers, ovens, barbecues etc. A similar process can be used on copper and silver to improve their appearance, especially when used for jewellery.

Like other processes used on metal, the surface must be degreased as part of the preparation. The surface is then brushed with a thin adhesive (polycell paste) which disperses when heat is applied. Powdered glass or minerals are then sieved to cover the adhesive on the metal object before being transferred to a kiln and heated to approximately 750°C. When the enamel melts and flows on to the product, it is removed and allowed to cool and harden. Decorative techniques are employed once the enamel hardens.

Lacquering

The addition of a lacquer is to provide a protective barrier against tarnishing and oxidising after polishing. Lacquer is a clear or coloured varnish that dries by solvent evaporation and often a curing process as well that produces a hard, durable finish, in a range of sheen levels and that can be further polished as required.

For lacquering metals, the surface preparation is similar to other types of finishing. It is recommended to clean the surface with paraffin or white spirit to remove grease. The lacquer is then applied, enabling the natural colour of the metal to be visible. Metals can also be chemically coloured, using potassium sulphide (brown) or ammonia and sodium acetate (green) prior to lacquering.



Revision questions

1. Products manufactured from metals use a range of finishes. Briefly explain the following processes:
 - a. Plastic coating
 - b. Electroplating
 - c. Anodizing
 - d. Enamelling
 - e. Lacquering