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METHODS FOR ELECTROPLATING METALS ON NONCONDUCTING MATERIALS

The following information is based principally on published papers and not on any extensive experience by this Bureau. The details of the various methods may require modification for specific products. Some knowledge of and experience in electroplating are desirable before attempting to conduct these operations on even a small commercial scale.

GENERAL PRINCIPLES

It is necessary to render the surface impervious and conducting before electroplating is applied. It is customary to first electrodeposit copper, upon which other metals may then be plated. A coating of clear lacquer is usually applied to the final surface to resist tarnish.

RENDERING THE SURFACE IMPERVIOUS

Glass and plastics are practically impervious to water. Wood may be rendered impervious by applying at least two coats of a good spar varnish. Plaster and leather articles such as baby shoes may be immersed in melted paraffin or beeswax, heated to about 212°F, until the bubbling caused by release of air or moisture nearly ceases. They are then removed and allowed to drain and to cool.

RENDERING THE SURFACE CONDUCTING

1. Silvering. Glass and plastics are coated with silver by chemical reduction (similar to the silvering of glass mirrors). The solutions and methods are described in NBS Circular 389, a copy of which may be purchased for 10 cents (stamps not accepted) from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

2. Copper or silver powder. Grease-free, finely divided copper powder may be purchased as "plater's copper bronze powder." If the copper powder obtained contains any grease or wax, it should be shaken in a bottle with gasoline, and the gasoline poured off. (Care, inflammable!) The dry copper

powder may be then brushed onto a wax surface, or onto a varnished surface that is slightly "tacky."

3. Other methods. A number of other methods for making surfaces conducting may be used in special cases, such as coating with graphite, evaporation of metal films, and spraying with molten metal. These methods are described in the following book: Metallizing Non-Conductors, Samuel Wein. Finishing Publications, Inc., 381 Broadway, Westwood, N.J.

In many cases, it is desirable to use a "conducting paint," made by mixing copper powder with lacquer that has been thinned with several times its volume of the appropriate thinner for that lacquer. The paint is brushed or sprayed on the varnished wood or waxed leather surface and allowed to dry.

A silver conducting paint is available already mixed.

A complete list of supplies of graphite and metallic paints and their addresses may be found in the Buyers Guide Issue of Chemical Week, a McGraw Hill publication available at libraries and from the publisher.

DEPOSITING COPPER

Copper may be electroplated from a solution containing in each gallon of water from 24 to 32 oz of crystallized copper sulfate (blue vitriol) and from 6 to 8 oz (4 to 5 fl oz) of sulfuric acid. This solution should be kept in a glass or stoneware jar. Strips or sheets of copper may be used as the anodes, and the articles to be plated are suspended by copper wires as cathodes. Direct current at 4 to 6 volts may be obtained from a storage battery, a rectifier, or a generator.

By means of a rheostat the current, measured with an ammeter, should be adjusted so that it is equivalent to from 10 to 20 amperes for each square foot of surface to be plated. At this current density about 0.0005 to 0.001 inch of copper is deposited per hour.

Details regarding this type of copper plating solution are given in NBS Circular 387, a copy of which may be purchased for 10 cents from the Superintendent of Documents, Washington, D. C.

TYPICAL PROCEDURE FOR PLATING LEATHER BABY SHOES

The following method has been found by practical platers to yield satisfactory results. The exact details may be varied in the light of experience.

The shoe is first adjusted to the desired shape and the laces and tongue are sewed in position. The inside of the shoe is rendered stiff and impervious by means of two coats of a good spar varnish. (Electroplaters generally use a special "stop-off" lacquer for this purpose.) The varnish is thinned down with an equal volume of thinner and is then poured into the shoe, allowed to stand a short time, and then poured out. The remaining film is allowed to dry thoroughly, e.g., for 24 hours. Undiluted varnish is then poured into the shoe and the excess is poured out. The resulting second coat is allowed to dry thoroughly.

The shoe is then immersed in melted paraffin or beeswax, which is heated only to about 212°F. When most of the bubbles of air or moisture have escaped, the shoe is removed from the wax, drained thoroughly and allowed to cool. During this cooling the shoe is adjusted to the exact shape desired.

A conducting paint is made by mixing 1.5 oz of grease-free copper bronze powder with 5 fl oz of a lacquer thinner, and finally adding 1 fl oz of a nitrocellulose lacquer. This paint should be mixed only as needed because on standing it tends to stiffen or "jell."

This paint may be sprayed or brushed onto the outer surface of the shoe that is to be plated. Application of two coats is more likely to cover every part of the surface. When dry, the resultant copper film should have a dull color. If it is bright, too much lacquer was used, and the copper particles may be coated over and hence may not be conductive.

Fine copper wires are attached to a few parts of the shoe to make electrical contact with the copper film. The shoe is then suspended by these wires from a copper rod that is connected as cathode. The plating solution contains 24 oz of copper sulfate (blue vitriol) and 6 oz (4 fl oz) of sulfuric acid in enough water to make one gallon of solution. This should be kept in a glass or stoneware jar. Strips of copper are hung from another copper rod and connected as anodes.

Current from a 6-volt storage battery or rectifier is passed through the solution from the anode to the cathode. By means of a simple rheostat, the current is adjusted (as shown by an ammeter) so as to be equivalent to about 12 amperes per square foot of surface to be plated. For example, if a rough measurement indicates that the outside surface of the shoe is about 48 square inches, or 1/3 square foot, a current of 4 amperes should be used.

After plating for about two hours, the shoe should be removed, rinsed, and examined. If the copper has not deposited on every part of the surface, the unplated part should be touched up with the copper paint, dried, and the plating repeated. It is desirable to change the position of the copper wires so as not to leave any mark in a noticeable position. Plating is then continued at about 8 amperes per square foot (i.e., 3 amperes for the above example) for about 36 hours. About every 5 hours the shoe may be removed and any nodules knocked off, or any rough places smoothed with emery paper.

After the copper plating is complete, the shoe should be thoroughly rinsed and dried, and coated with a clear lacquer. If a bronze finish is desired, the copper surface (before lacquering) is treated with a dilute solution of sodium sulfide until it just turns black. Part of the black surface is removed by a fine scouring powder, and the surface is cleaned and lacquered.

Gold or silver may be plated on the copper by the usual methods.

Prepared by: WB/EED
Electrodeposition Section
Chemistry Division
National Bureau of Standards