



World Skill Development Institute

Electroplating and Surface Coating Technology

Course Duration – 1 Year

Electroplating and Metal Finishing concerns itself with the development and applications of composites and non metallic coatings. These coatings are used for decorative, protective and functional application. Some of the other common metal surface finishing technologies are phosphating, pickling, electroforming, powder coating etc. Electroplating is the process of applying a metallic coating to an article by passing an electric current through an electrolyte in contact with the article, thereby forming a surface having properties or dimensions different from those of the article. Metal finishing has now come to be known as surface engineering. Surface engineering techniques are generally used to develop a wide range of functional properties. In addition to the decorative aspects, metal finishing aids the protection of metals and alloys from corrosion and rusting. A great potential exists for development of new materials involving, for example, coatings of metals composites particle incorporated anodic coatings and even films of sapphire like materials, porous files of niobium etc. and coating of refractory metals like molybdenum and tungsten. Phosphate coatings have a wide field of application in manufacturing industry, both as an aid to mechanical production operations and in surface finishing. The major applications for phosphate treatments fall into four areas; pre treatment prior to organic coatings, protection against corrosion, anti wear coatings and phosphating as a production aid. Powder coating of aluminium, extrusions in particular, has become an important feature in the finishing of aluminium. There are several advantages of powder; powder coating overspray can be recycled and thus it is possible to achieve nearly 100% use of the coating, powder coating production lines produce less hazardous waste than conventional liquid coatings, capital equipment and operating costs for a powder line are generally less than for conventional liquid lines. Surface finishing is a broad range of industrial processes that alter the surface of a manufactured item to achieve a certain property. Currently, the trend is towards surface treatments. Industries in developing countries like India have to be increasingly aware of the need not only for up gradation of existing technologies but also for indigenization of new technologies on a time bound basis.

The content of the course includes information about technology involved in surface engineering of metals; some of them are electroplating plant, barrel plating plant, electroplating equipment, cleaning, pickling and dipping, equipment for hot alkaline cleaners, electrolytic and chemical processes for the polishing of metals, canning stainless steel electro-polishing solution, electroforming in gramophone record production, silver plating, fluoborate plating, gold plating (gilding), cadmium plating, zinc plating, chemical finishing of aluminium, powder coating of aluminium, bright nickel electro plating, copper plating, etc.

This course covers an intensive study of technology of electroplating, phosphating, powder coating and metal finishing. The first hand information on these technologies is dealt in the course and can be very useful for those looking for entrepreneurship opportunity in the said industry.

1.ELECTROPLATING PLANT

Automatic Equipment

Fixed Sequence Automatic Plating Plant

Trojan and Gem Type Automatic Plant

Vulcan Lattice Arm Type Automatic Plant

Titan Type Automatic Plant

Digit Pivoted Arm Type Automatic Plant

Straight-through Type Automatic Plant

The Glydo System

Special Transporter Designs

Methods of Transporter Control

Programmed Controllers

Programme Preparation

Programming Systems

Photo-Electric Cell Type Reader

Microprocessor and Computer Control

Semi-Automatic Plating Plant

Barrel Planting Plant

Suitability of Articles for Barrel Plating

Barrel Types

Immersed Perforated Plating Barrels

Glydo/Glydette Barrel Plating Equipment

Horizontal Barrels

Barrel Perforations

Cathode Contacts

Current Control

Voltage

Speed of Barrels

Anodes

Types of Cathode Contacts

Calculation of Work Loads

Perforated Obliquic Barrels

Single Station Barrel Plating Units

Horizontal Barrels

Open-ended Plating Barrels

Manual Planting Plant

Modular Plant and Specialised Equipment for the Electronics Industry

Uniplan

Uniplan Barrel Plating

2.ELECTROPLATING EQUIPMENT

Process Tanks

Welded Steel Tanks

Plastic Tanks

Plastic Tanks Reinforced with Glass Fibre

Glass Fibre (GRP) Tanks

Stainless Steel

Tank Lining Materials

Rubber

Treatment of Rubber Linings

Key to Table

Polyvinyl Chloride

Ilex Grade Plastic Lined Tanks

Lead

Materials of Construction—Containers, Hooks, Dipping Baskets

Aluminium

Glass

Brass, Bronze and Copper

Monel Metal

Nichrome (Chrome Wire)

Rods & Connections for Process Tanks

Solution Heating

Stem Heating

Steam Coils

Plain Steel Coils

Galvanised Steel Coils

Lead and Lead Alloy Coils

Titanium Coils

Zirconium Coils

Tantalum Coils

Incoloy 825 Coils

Stainless Steel Coils

Fluorocarbon Coils (Dupont Teflon Heat Exchangers)

External Heat Exchangers

Water Jackets

High and Medium Pressure Hot Water Heating

Liquid Phase Heating

Gas Heating

Electric Heating

Metal Cased Heaters

Teflon Immersion Heaters

Silica Cased Heaters

Earthing of Electrically Heated Tanks

Electric Heating of Plastic or Plastic Lined Tanks

Solution Level Control

Lagging and Heat Conservation

Chroffles

Calculation of Heating Requirements

Allowance for Heating Losses

Steam Boilers

Hot Water Boilers

Gas Heating

Electric Heating

Temperature Control

Temperature Indicators

Thermostatic Control Equipment

Solution Cooling

Solution Agitation

Air Agitation

Mechanical Work Movement

Fume Extraction and Shop Ventilation

Fume Scrubbers and Demisters

Filtration of Solutions

Sentinel Filter Units

Sieber Filter Units

Hendor Filter Units

Solution Circulation and Transfer

Filter Media & Filter Aids

Filter Media

Filter Aids

Pumps for Pressure Filtration

Pipework for Filtration

The Drying of Components

Centrifugal Dryers

Automated Centrifuge Units

Hot Air Ovens

Hot Sawdust and Grit-o-cobs

Jigs & Racks For Electroplating, Anodising and Other Surface Coatings and Treatments

Plating Jig Design

Jig Contacts

Anodising Jigs

Jig Insulation

Safety Precautions

Ohmax Coating Procedure

Equipment

Maintenance

Removal of the Insulated Coatings

3.ELECTRICAL EQUIPMENT

Rectifiers Rectifier Rating

Rectifier Installation and Maintenance

Single Phase Rectifier Units

Rectifier Control

Auto-transformers

Stepless Regulators

Thyristor controlled rectifiers

Constant Voltage and Constant Current Control

Controllers for Anodic Oxidation Processes

Automatic Control

Current Interrupters and Periodic Reverse Units

Periodic Control Units for use with separate rectifiers

Electrical Instruments

Ammeters

Voltmeters

Ampere Time Meters

Pre-setting Ampere-time Meters and Panels

Heavy Current DC Switch-gear

Connecting Up Plating Equipment

D.C. Wiring Systems

Busbars

Busbar Ratings

Busbar supports

Jointing with flat busbars

Copper Rod and Flexible Conductors

4.CLEANING, PICKLING AND DIPPING

Routine Operations in Cleaning

Preliminary Cleaning and Degreasing

Solvent Cleaning

Aqueous Neutral Detergent Pre-Cleaners

Mersol Soak Cleaner

Solution Composition

Solution Preparation

Operating Conditions

Operating Procedure

Ultrasonic Cleaning

Alkaline Cleaners

Hot Alkaline Cleaners

Classification of Metal Cleaners

Electrolytic Cleaning

Equipment for Hot Alkaline Cleaners

Barrel Cleaning

Activax Cleaner

Equipment

Solution Preparation

Solution Concentration and Operating Conditions

Cleaning of Zinc Base Alloy Die Castings

Barrel Cleaning

Solution Maintenance

Nuvax Cleaner

Equipment

Solution Preparation

Cleaning of Zinc Base Alloy Die Castings

Barrel Cleaning

Solution Concentration and Operating Conditions

Solution Maintenance

Cleaner

Equipment

Solution Preparation

Solution Concentration and Operating Conditions

Solution Maintenance

Multiklense

Equipment

Solution Preparation

Solution Maintenance

Cleaner No. 50

Solution Concentration and Operating Conditions

Solution Composition

Solution Preparation

Operating Conditions

Solution Maintenance

Anozyn

Equipment

Solution Composition

Solution Preparation

Operating Conditions

Solution Maintenance

10-15 Cleaner

Equipment

Solution Concentration and Operating Conditions

Solution Preparation

Solution Maintenance

10-55 Cleaner

Equipment

Solution Preparation

Operating Conditions

Solution Maintenance

Emphax

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Zonax Metal Cleaner

Solution Concentration and Operating Conditions

Anodax Metal Cleaner

Equipment

Solution Composition

Solution Preparation

Operating Conditions

Solution Maintenance

Alkaline Cleaners for Aluminium

For Cleaning without Etching the Surface

For Light Etch Cleaning of Aluminium

For Frosted Etch Finish

Minco Cleaner

Equipment

Solution Concentration and Operating Conditions

Solution Maintenance

Kelco Cleaner

Equipment

Solution Composition

Solution Preparation

Operating Conditions and Procedure

Solution Maintenance

Maintenance of Metal Cleaners

Additions of Metal Cleaner

Pickling and Dipping

Zonax Dry Acid Salt

Equipment

Solution Concentration and Operating Conditions

Solution Preparation

Sulphuric Acid Pickling

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Hydrochloric Acid Pickling

Solution Composition

Equipment

Operating Procedure

Skalene Pickle for Iron and Steel

Alkaline Deruster Salts

Additional Uses of Alkaline Deruster Salts

Equipment

Section A Cyanide-free Solution for Rust Removal

Solution Composition

Solution Preparation

Operating Conditions

Section B. Cyanide Solution for Rust and Scale Removal

Solution Composition

Operating Conditions

Process Sequence used in Sections A and B

Treatment of High Tensile Steels

Spray Suppression

Effluent Treatment

Solution Maintenance

Hydrofluoric Acid Pickling

Solution Composition

Equipment

Operating Procedure

Pickling of Magnesium Alloys

Pickling of Stainless Steel

Equipment

Operating Procedure

Pickle Aid

For Combined Pickling and Degreasing Solutions

As a Spray Suppressant

Equipment

Concentration

Operating Conditions

Solution Maintenance

Bright Dipping of Copper Alloys

Aqua Fortis Bright Dipping Acid

Solution Composition

Equipment

Bright Dipping Procedure

Chromic Acid Dip for Brass, Copper and its Alloys

Solution Composition

Equipment

Operating Procedure

Nitric Free Bright Dip C22924 for Copper and its Alloys

Solution Composition

Equipment

Operating Procedure

Solution Maintenance

Barrel Pickling

Second Stage or Surface Activation Cleaning

Cyanide Containing Cleaners

Klenowell

Equipment

Solution Composition

Solution Preparation

Operating Conditions

Operating Procedure

Solution Maintenance

Kleenax

Solution Concentration

Operating Conditions

Operating Procedure

Solution Maintenance

Non-Cyanide Cleaners

Activax Cleaner

10-55 Cleaner and Anodax Metal Cleaner

Anozyn

Alkaline Deruster

Emphax Cleaner

Acid Etching

Anodic Sulphuric Acid Etching of Iron and Steel

High Concentration Acid Etch for Steel

Equipment

Solution Composition

Solution Preparation

Operating Conditions

Operating Procedure

Solution Maintenance

Acid Etching of Steel and Iron before Heavy Deposition

Solution Composition

Solution Preparation

Operating Conditions

Solution Maintenance

Pre-Treatment Systems

Pre-Cleaning

Typical Cleaning Cycles

Nickel Plating of Mild Steel

General Method

Where a cyanide-free cleaning line is required

Use of a sulphuric acid etch to ensure maximum adhesion of deposit

D.â€™Energy Saving Cleaning Line

Cadmium and Zinc Plating of Mild Steel

Rack Plating

Notes

Barrel Plating

Notes

Plating on High Carbon Steel

Plating on Cast Iron and Malleable Castings

Plating on Stainless Steel

Nickel Chloride Strike for Stainless Steel

Nickel Sulphate Strike for Stainless Steel

Nickel Plating of Brass and Other Copper Alloys

General Method

Alternative method where a cyanide-free cleaning line is required

Nickel Plating of Copper

Nickel Plating of Leaded Brass

Copper and Nickel Plating on Zinc Base Alloy Die-Castings

Plating on Aluminium and its Alloys

The Bondal Process

Bondal Cleaner

Equipment

Solution Composition

Solution Preparation

Operating conditions

Solution Maintenance

Bondal Dip

Standard process sequence for electro-plating on
aluminium and its alloys

Modification to the standard process

Articles likely to carry over solution

Articles having unpolished areas

Deposition of metals other than nickel

Jigging

Dips and Rinses

Dilute Acid Dips

Cyanide Dips

Rinsing or Swilling

Rinse-Aid

Scouring

5.ELECTROLYTIC AND CHEMICAL PROCESSES FOR THE POLISHING OF METALS

Electro-polishing Solutions

Aluminium and Aluminium Alloys

Aluminium Electro-polishing Solution

Equipment

Solution Composition

Solution Preparation

Operating Conditions

Operating Procedure

Solution Maintenance

Brytal Process

Equipment

Operating Conditions

Desmutting

Stainless Steels

Canning Stainless Steel Electro-polishing Solution

Solution Composition

Equipment

Operating Conditions

Process Sequence

Solution Maintenance

Copper, Brass and Nickel Silver

Canning Non-Ferrous Electro-polishing Solution

Solution Composition

Equipment

Operating Conditions

Process Sequence

Solution Maintenance

Chemical Polishing of Aluminium

Typical Operating Conditions

6.COPPER PLATING

Properties of Copper

Decorative Applications

Functional Applications

Copper Plating Solutions

Rates of Deposition and Specification Requirements

Cathode Efficiency of Copper Plating Solutions

Rates of Deposition

Deposit Specifications

Equipment

Cyanide Solutions

Anodes

Cyanide Copper Plating Processes

Copper Strikes

pH Control

Cuprax High Efficiency Copper Solution

Anodes

Solution Composition

Operating Conditions

Solution Maintenance

Purification

Analytical Standards

Plating Procedure for Zinc based diecastings

Zonax Copper Solution

Anodes

Solution Composition

Operating Conditions

Maintenance of the Solutions

Low Cyanide Strike Solution for Cast Iron, Lead and Soldered Articles

Analytical Standards

Rochelle Copper Solution

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Acid Copper Plating Processes

Cuprasol Mk 2 Bright Levelling Acid Copper Plating Solution

Preparation of the Cuprasol Mk. 2 Base Solution

Solution Composition

Operating Conditions

Solution Maintenance

Chloride Content

Visual Control of the Cuprasol Solution

Acid Copper Sulphate Solution

Solution Compositions

Operating Conditions

Solution Maintenance

Correction of Faults in Acid Copper Sulphate Solutions

Copper Pyrophosphate Plating Solution

Super Pyrobrite Copper Pyrophosphate Plating Solution

Solution Composition

Solution Maintenance

Plating Procedure

Neutral Copper Plating Solutions

Solution Composition

Operating Conditions

Plating Procedure

Immersion Plating Without Applied Current

On Steel

Solution Composition

On Brass

Solution for Barrel Copper Plating

Barrel Plating with Zonax Copper Solution

Solution Compositions

Operating Conditions

Maintenance of Solutions

Analytical Standards

Barrel Plating With Cuprax Copper Solution

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Barrel Plating in Rochelle Copper Solution

Operating Conditions

Analytical Standards

Solutions for Heavy Copper Deposition

Cuprasol Mk. 2 Acid Copper Plating Process for Heavy Deposits

Preparation of the Acid Copper Base Solution

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Copper Fluoborate Solution

Equipment

Operating Conditions

Solution Maintenance

Purification

Analytical Standards

Super Pyrobrite Copper Pyrophosphate Plating Solution

Properties of the deposit

Operating Conditions

Purification

Cuprax Cyanide Copper Solution

Copper Plating Procedure

Cyanide Copper Solutions

Zinc Base Alloy Diecastings

Special Techniques used in Printing Application

Photogravure

Building Up Copper Cylinders

Skin Deposits

Cast Iron and Steel Cylinders

Aluminium Cylinders

Copper Electrotype

Lithography

Stopping-Off

Methods for Stripping Copper Deposits

From Steel

Universal Stripping Salts for Steel

Alkaline Cyanide Solution

Immersion Process

Sulphuric Acid Etch

From Zinc Alloy Diecastings

7.ELECTROFORMING

Applications of Electroforming

Materials for Electroforming

Nickel Solution

The Watts Solution

The Sulphamate Solution

The Ni-speed Solution

Zero-stress conditions for the Ni-speed process

Nickel/Cobalt Alloy Solutions

Copper Plating Solution

Throwing power

Sodium High-Sulphate Nickel Solution

Operating Techniques

Mandrels for Electroforms

Permanent Mandrels

Stainless steel

Mild Steel

Copper and Brass

Electroformed Nickel

Rigid Plastic

Collapsible Plastics

Expendable Mandrels

Aluminium

Zinc alloys

Fusible alloys

Plastics

Wax

Other Materials

Post Plating Treatment

Electroforming in Gramophone Record Production

Printing Application

Printing Methods

Electroplating Techniques Special to the Printing Industry

Electroplating Solutions used in the Printing Industry

8. BRASS PLATING

Decorative Brass Plating

Zonax Brass Solution for Decorative and General Plating

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Colour Consistency and Control

Analytical Standards

Plating Procedure

Brass Plating upon Cast Iron and Lead

Barrel Brass Plating

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Brass Plating for Rubber Adhesion

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Plating Procedure

Correction of Faults in Zonax Brass Plating Solutions.

9.SILVER PLATING

Cyanides Systems

High-Speed Selective Plating

Non-cyanide System

Iodide Solutions

Trimetaphosphate Solution

Thiosulfate Solutions

Succinimide Solutions

Organic Solvent Solutions

Summary

Tin, Lead, and Tin-Lead Plating

Additives

Tin, Lead, and Tin-Lead Plating Baths

Tin Barrel, Still, and High-Speed Baths

Lead Barrel and Still Baths

60 Tin/40 Lead Solder Barrel, Still, and High-Speed Baths

90 Tin/10 Lead Barrel, Still, and High-Speed Baths

93 Lead/7 Tin Barrel and Still Baths

10 Tin/88 Lead/2 Copper Ternary Alloy Barrel and Still Baths

Fluoborate Plating

Methane-Sulfonic-Acid-Based Plating

Tin Plating From Stannate Baths

Anodes in Stannate Baths

Operation of Stannate Baths

Reflowing Tin Deposits

Determination of Acid Neutralization Value

10.TIN-NICKEL ALLOY PLATING

Properties and Applications

The Plating Baths

Chloride-Fluoride Baths

Chloride-Fluoride Solution Preparation

Solution Agitation

Anodes

Effects of Process Variables

Effects of Solution Contaminants

Table 4. Solution Composition and Control Limits for Pyrophosphate-Glycine Bath

Pyrophosphate-Glycine Bath

Troubleshooting Guidelines

11.GOLD PLATING (GILDING)

Properties of Gold

History of Gold Plating

Applications of Gold Plating

Rates of Deposition and Specification Requirements

Specification Requirements

Undercoats

Corrosion Resistance

Carat Value

Equipment for Gold Plating

Anodes

Effluent Treatment

Gold Deposits and Solutions

Ultra-pure Gold Deposits

Low-Alloy Gold Deposits

High-Alloy Decorative Golds

General Gold Plating Procedure

Plated Undercoats

Barrier Layers

Strike solutions

Post plating treatment

Traditional Gold Plating Practice (Gilding)

Gilding Articles Inside

Immersion Gilding

Stripping Gold Deposits

Electrolytic Process for Stripping Flux and Oxide from Gold

12.CADMIUM PLATING

Properties of Cadmium

Applications and Corrosion Resistance

Cadmium Deposits on Non Ferrous Metals

Passivation Processes

Specification Requirements and Rates of Deposition

Rates of Deposition and Plating Times

Determination of Deposits Thickness

Strip and re-weigh method for average thickness of cadmium deposits

Test for Porosity of Deposit

Cadmium Plating Equipment

Cadmium Plating Solutions

Cadmium Plating Salts

Zonax Candmium Plating Solution

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Kadax Cadmium Solution for Barrel Plating

Solution Composition

Operating Conditions.

Solution Maintenance

Analytical Standards

Kadamax High Speed Bright Cadmium Plating Solution

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Cadmium Plating Procedure

Cleaning and Preparation of Work

Removal of Embrittlement

Treatment after Cadmium Plating

Kadip Bright Dip

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Chromic Acid Dip

Equipment

Solution Composition

Operating Conditions

Stripping Cadmium Deposits

Using Ammonium Nitrate Solution

Using Ammoniacal Persulphate Solution

Using Hydrochloric Acid

13.ZINC PLATING

Properties of Zinc

Applications Corrosion Resistance

Specification Requirements and Rates of Deposition

Thickness Requirements for Zinc Deposits

Determination of Thickness of Zinc Deposit

Rate of Deposition

Zinc Plating Equipment

Cyanide solutions

Zinc Plating Solution

Cyanide Zinc Plating Solutions

Base Solution Composition

Unizin Universal Zinc Brightner

Anodes

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Purification

Hylite 80 Bright Zinc Solutions

Solution Composition

Operating Conditions

Solution Maintenance

Zinc Oxide

Zinc Cyanide

Purification

Analytical Standards

Treatment after Plating

Cyanide Zinc Plating Procedure

Cleaning and Preparation of Work

Treatment After Zinc Plating

Bright Zinc Plating

Dilute Nitric Acid Bright Dip

Dull Zinc Plating

Correction of Faults In Cyanide Zinc Plating Solutions

Alkaline Non-Cyanide Zinc Solutions

Envirozin 2 Bright Alkaline Non-Cyanide Solution

Solution Composition: Rack

Solution Composition: Barrel

Solution Preparation

Operating Conditions

Rate of Deposition

Solution Maintenance

Analytical Standards

Purification

Alkaline Non-Cyanide Plating Procedure

Acid Zinc Plating Solutions

Zincalux Bright Acid Zinc Solution

Solution Composition

Operating Conditions

Rate of Deposition

Solution Maintenance

Purification

Analytical Standards

Treatment after Plating

Chloride Zinc Plating Solution

Equipment

Solution Composition

Operating Conditions

Rate of Deposition

Solution Maintenance

Treatment of Work after Plating

Acid Zinc Plating Procedure

Stopping-off

Stripping Zinc Deposits

Immersion Process

Correction of Faults in Acid Chloride Zinc Plating Solutions

Electrolytic Process

14.PASSIVATION PROCESSES FOR ZINC AND

CADMIUM ELECTRODEPOSITS

Drying

Passivation Processes For Zinc and Cadmium

Full Passivation Processes

Zonax Passivating Salts

Equipment

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Chromate Passivation Solution To D.E.F. 130

Equipment

Solution Composition

Operating Conditions

Process Sequence

Analytical Standards

Solution Maintenance

Autopass Salts

Equipment

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Production of Blue Chromate Coating

Full Passivation Concentrate

Equipment

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Production of Blue Chromate Coating

Heavy Bronze Passivation

Solution Composition

Operation Conditions

Process Sequence

Solution Maintenance

Black Chromate Passivation For Zinc

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Olive Drab Chromate Passivation

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Black Finish

Light, Colourless or Blue Passivation Process

Blue Passivating Salts For Zinc

Equipment

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Bright Passivation For Zinc

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Zinc Chromate Passivation

Equipment

Solution Composition

Operating Conditions

Process Sequence

Solution Maintenance

Iridex

Colourless Passivation on Cadmium

Equipment

Solution Composition

Operating Conditions

Coloured Finishes

Black Dye for Olive Drab Passivation

Blue Identidye

Equipment

Operating Sequences

Test Procedure For Passivated Films

Spot Test Solution for Chromate Passivation Films

15. THE PLATING OF PLASTICS AND OTHER

NON-METALLIC MATERIALS

Plating-on-Plastics

Applications and Advantages

Properties of Plated Plastics

Moulding for Plating on Plastics

Physical faults and their effects

Faults caused by variations in machine parameters

Simplas Process

Equipment

Swilling or Rinsing

Cleaning

Pre-etch

Hot Alkaline Cleaner

Etching

Etch Composition for ABS Type Polymers

Operating Conditions

Solution Maintenance

Analytical Standards

Etch Composition: For PP co-polymers

Alternatives:

Operating Conditions

Solution Maintenance

Analytical Standards

Neutralising

Solution Composition

Solution Maintenance

Simplas Neutraliser

Solution Composition

Operating Conditions

Activation

Solution Composition

Operating Conditions

Solution Maintenance

Acceleration

Solution Composition

Operating Conditions

Niplas Electroless Nickel

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Solution Life

Analytical Standards

Electroplating on Electroless Nickel Plated Surfaces

Plating Jigs

Barrel Plating of Plastics

Barrel Plating Technique

Silvering

Spray Silvering

Solution Composition

Operating Procedure

Sensitiser

Immersion Silvering

Operating Procedure

Electroplating on Silvered Surfaces

Jigging

Special Techniques Used In Printing Applications

Metallising with Copper Bronze Powder

Preparation

Metallising

Electroplating

Polishing with Powered Graphite

Vacuum Evaporation and Electrical Sputtering

16. PLATING FOR ELECTRONICS

Printed Circuits

Specialist Processes for Printed Circuit Production

Print and Etch Circuits

Applying the Resist

Producing the Circuit Pattern

Etching

Finishing

Plated Through Hole Circuits

Drilling

Pretreatment

Additive Circuitry

Semi-Additive circuits

Fully Additive Circuits

Gold Plating of Edge Connectors

65 Copper Etchant For Printed Circuits

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Analysis of 65 Copper Etchant

Estimation of Hydrogen Peroxide in Bath

Estimation of Copper in Bath

Copper Recovery

P.D. Activator for Printed Circuits

Solution Composition

Operating Conditions

Cuprasol PTH Copper Plating Process

Equipment

Solution Composition

Operating Conditions

Preparation of Cuprasol PTH Base Solution

Solution Preparation

Analytical Standards

PTH Tin/Lead Plating Solution

Equipment

Solution Composition

Operating Conditions

Solution Maintenance

Analytical Standards

Dekote PB/SN 1

Equipment

Solution Composition

Operating Conditions

Operating Procedure

Solution Maintenance

Dekote Au

Equipment

Solution Composition

Operating Conditions

Operating Procedure

Solution Maintenance

17. PHOSPHATING PROCESSES

Applications

Pre-treatment Prior to Organic Coatings

Protection against Corrosion

Anti-wear Coatings

Phosphating as a Production Aid

Types of Phosphate Coating

Iron Phosphate

Zinc Phosphate

Manganese Phosphate

Lead Phosphate

Surfaces To Which Phosphate Coatings May Be Applied

Preparation of Surfaces for Phosphating

Specifications

British Standard 1389: 1973 Phosphate Treatment of Iron and Steel

DEF STAN 03-11/1 Phosphate Treatment of Iron and Steel

Treatment of High Tensile Steels

Equipment for Phosphating

Immersion Phosphating Plant

Spray Phosphating Equipment

Tanks

Solution Heating

Fume Extraction

Sludge Removal

Phosphating Processes

Key to Table

Light Weight Iron Phosphate Processes

Canphos 301

Canphos 304

Equipment

Solution Composition and Operating Conditions

Preparation of the 300 Range Phosphating Solutions

Operating Sequences

Solution Maintenance

Heavy Zinc Phosphate Processes

Equipment

Canphos 401

Canphos 402

Solution Composition and Operating Conditions

Preparation of the 400 Range of Phosphating Solutions

Solution Maintenance

Visual Control

Calcium Modified Zinc Phosphate Processes

Canphos 501

Canphos 504

Canphos 509

Equipment

Solution Preparation

Operating Sequences

Solution Maintenance

Addition Rates

Light Weight Zinc Phosphate Processes

Canphos 505

Canphos 508

Solution Composition and Operating Conditions

Solution Preparation

Solution Maintenance

Addition Rates

ManganEsE Phosphate Processes

Canphos 601

Equipment

Solution Composition

Operating Conditions

Solution Preparation

Operating Sequences

Solution Maintenance

Phosphating Process Sequences

Pre-Treatment Processes

Alkaline Cleaners

Equipment

Maintenance

Defoaming

Pickling and Derusting

Conditioning

Post Phosphating Treatments

Sealing Treatment

Chromic Rinse Solution (DEF STAN 03-11/1)

Equipment

Oils and Lubricants

Black Finishes

Sealphos 721 Black Stain

Sealphos 708 Matt Black

Aluminium Pre-Treatment

Alibond 802

Equipment

Solution Composition

Operating Conditions

Operating Sequence

Solution Maintenance

Solution Analysis

General Phosphating Information

Sludge Removal

Control of Solution Composition and Chemical Balance

Effluent Treatment

18.CHEMICAL FINISHING OF ALUMINIUM

Introduction

Etching

Alkaline Etching

Acid Etching

On-Site Etching

Bright Etching

Chemical Brightening

Electro-brightening

19.ELECTROPLATING ON ALUMINIUM

Background To Plating

Advantages of Electroplating Aluminium

Examples of Electroplated Aluminium

Alloys for Plating

Processing

Early Pre-treatment Methods

Preplating Procedures

1 Polishing

2 Jigging

3 Cleaning

4 De-smut

5 Pre-treatment

Electrodeposition

20.CHEMICAL COLOURING OF ALUMINIUM

Introduction

Conversion Coatings

Thickened Oxide Coatings

21.ELECTROPAINTING OF ALUMINIUM

The Process

Principles of Electropainting

Process Details

Jigging

Pre-treatment

Paint Application

4 Rinsing and Ultrafiltration

Stoving

Costs

Conclusion

Developments

The Future

22.POWDER COATING OF ALUMINIUM

Method of Application

Equipment

Electrostatic Generator and Gun

Powder Recovery

Stoving

Powder Coating Production

Colour

Thermoplastic Powder Coatings

Polyethylene (Polythene)

PVC

Nylon

Factors Affecting Use of Thermo-plastic Coatings

23.BRIGHT NICKEL ELECTRO-PLATING

Brighteners

Levellers

Stress Relievers

Wetting Agents

Properties of electro-deposited bright nickel

Brightness

Reflectivity

Roughness and Pitting

Porosity

Corrosion Resistance

Chromability

Adhesion and Surface Preparation

Ductility

Internal Stress

Hardness

Effect of hydrogen absorption

Properties of Bright Nickel Baths

Stability

Cathode and anode efficiencies

Operating range

Simplicity of operation

Throwing power

The incorporation and effect of organic addition agents

Mechanisms of incorporation of organic compounds in electro-deposits

Cathodic Reduction

Interaction of organic additions

Levelling

Effect of additives on structure

Grain size, orientation and brightness of electro-deposits

Effect of additions on stress, ductility and hardness

Stress first decreases, then rises as concentration is increased.

24.ELECTROPLATING SOLUTIONS

Brass and Bronze Plating

White Brass

Bronze Plating

Cadmium Electro-plating

Alkaline Cyanide Baths

Preparation of the Plating Bath

Production Plating Conditions

Acid Sulfate Baths

Preparation of the Plating Bath

Production Plating Conditions

Neutral Chloride Baths

Preparation of the Plating Bath

Production Plating Conditions

Acid Fluoborate Baths

25.DECORATIVE CHROMIUM PLATING

Chemistry for Hexavalent Chromium

Chemistry Trivalent Chromium

Operations

Equipment

Waste Treatment

Corrosion Protection

Decorative Black Chromium

Bulk Chromium Plating

26.FUNCTIONAL CHROMIUM PLATING

Chemistry

Operating Conditions

Power Supply

Anodes

Fixturing and Rack Design

Stop Offs

Tapes

Lacquers

Wax

Shields and Robbers

Specialty Chromium Baths

Trivalent Chromium

Black Chromium

Porous Chromium

Environmental Concerns

Air Handling

Impurity Removal From a Plating Bath

Regulations

27.COPPER PLATING

Copper Cyanide Baths

General Purpose Strike

Strike-Plate Bath

High-Efficiency Bath

Barrel Plating

Bath Preparation

Maintenance and Control

Constituents

Temperature

Agitation

Contamination

Carbonate

Copper Pyrophosphate Plating Baths

Strike

Typical Pyrophosphate Bath

Printed Circuit Bath

Maintenance and Control

Constituents

Temperature

Agitation

Contaminants

Orthophosphate

Other Alkaline Baths

Copper Sulfate Baths

Standard Acid Copper Plating

High-Throw Bath

Bath Preparation

Maintenance and Control

Constituents

Temperature

Agitation

Contaminants

Copper Fluoborate Bath

Maintenance and Control

28. GOLD PLATING

Decorative Gold Plating (Classes A–C and, sometimes, G)

Barrel Plating (Classes A and B)

Antique Golds (Classes A and B)

Heavy Decorative Gold (Classes C-1 and C-2)

Industrial/Electronic Gold Plating

Alkaline Cyanide Baths (Group 1, Class D)

Neutral Cyanide Solutions (Group 2, Class D)

Acid Cyanide Plating Solutions (Group 3, Class E)

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