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 applications. 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 the development of new materials, involving, for example, coatings of metals composites, particle-impregnated anodic coatings, and even films of sapphire-like materials, porous films 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: pretreatment 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 surface finishing of aluminium. There are 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 the upgradation of existing technologies but also for the indigenization of new technologies on a time-bound basis.

The content of the book includes information about technology involved in surface engineering of metals; some of them are electroplating plant, barrel planting 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 book 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 book and can be very useful for those looking for entrepreneurship opportunities 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 Oblique 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 (â€˜Chromeâ€™ 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
Multiklene
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
Klenewell
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.- 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
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 Electrotypes
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-spoed 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
Refloowing 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
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 Brightener
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
Striping 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
Electrobrightening
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 for 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 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)

Directory Section

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.


NPCS also publishes varies process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.