# The Complete Technology Book on Electroplating, Phosphating, Powder Coating and Metal Finishing (2nd Revised Edition)

Author: - NIIR Board of Consultants &

Engineers

Format: paperback

Code: NI129 Pages: 504

Price: Rs.1675US\$ 150

Publisher: NIIR PROJECT CONSULTANCY

SERVICES

Usually ships within 5 days

The Complete Technology Book on Electroplating, Phosphating, Powder Coating and Metal Finishing (2nd Revised Edition)

Electroplating is the process of depositing a metal coating onto the surface of an object through the use of an electrical current. Electroplating has evolved into a highly complex process requiring a high level of precision and expertise. Phosphating is the process of converting a steel surface to iron phosphate. This is mostly used as a pretreatment method in conjunction with another method of corrosion protection.

Powder coating is a finishing process in which a coating is applied electrostatically to a surface as a free-floating, dry powder before heat is used to finalize the coating. The powder can be made of any number of products: polyester, polyurethane, polyester-epoxy, straight epoxy, and acrylics. Metal finishing is the final step in the manufacturing process used to provide aesthetics and environmental protection.

The electroplating market mostly is driven by the electronics and electrical industry and followed by the automotive industry. The demand for electroplating is rising rapidly from the end user industries which propel the growth of the market. The increasing demand for durable metals and growing use of adaptable manufacturing processes for a wide range of applications in the automotive, aerospace & defense, and electrical & electronics industries are likely to boost the demand for electroplating. With the growing demand for high-performance automobile components having excellent resistance to corrosion to enhance the appearance of exterior automobile parts, such as emblems, door handles, hood ornaments, and wheel rims, is driving the demand for electroplating and likely to continue owing to the increasing automobiles production in Asia-Pacific and other emerging economies in the Middle East & Africa. The zinc-nickel electroplating is one of the popular methods of electroplating in the automotive industry.

The book cover various aspects related to different Electroplating, Phosphating, Powder Coating and Metal Finishing with their manufacturing process and also provides contact details of machinery suppliers with equipment photographs and plant layout.

A total guide to manufacturing and entrepreneurial success in one of today's complete process

of electroplating to metal finishing in industry. This book is one-stop guide to one of the fastest growing electroplating, phosphating, powder coating and metal finishing industry, where opportunities abound for manufacturers, retailers, and entrepreneurs. The book serves up a feast of how-to information, from concept to purchasing equipment.

#### Contents

## 1. INTRODUCTION

#### 2. 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** 

**Active 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** 

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

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

## 3. 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** 

## 4. 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 Sollution

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

5. 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

## 6. 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.

#### 7. SILVER PLATING

Cyanides Systems

**High-Speed Selective Plating** 

Non-cyanide System

**lodide 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

# 8. 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

#### 9. 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 Thikness** 

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

## 10. 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

# 11. 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

# 12. 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

Canphos

Solution Composition and Operating Conditions

Preparation of the 400 Range of Phosphating Solutions

Solution Maintenance

Visual Control

Calcium Modified Zinc Phosphate Processes

Canphos

Canphos

Canphos

Equipment

Solution Preparation

**Operating Sequences** 

Solution Maintenance

**Addition Rates** 

Light Weight Zinc Phosphate Processes

Canphos

Canphos

Solution Composition and Operating Conditions

Solution Preparation

Solution Maintenance

**Addition Rates** 

ManganEsE Phosphate Processes

Canphos

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

#### 13. 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

## 14. 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

### 15. BRIGHT NICKEL ELECTROPLATING

**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.

#### 16. BIS SPECIFICATIONS

## 17. PHOTOGRAPHS OF MACHINERY WITH SUPPLIER'S CONTACT DETAILS

**Electroplating Rectifiers** 

Electroplating Process Tank

Rotating Barrel

**Auto Stat** 

**Automatic Voltage Controller** 

**Automatic Powder Coating Plant** 

ED Coating Plant / CED Coating Plant

Control panels

**Advance Controller** 

**Painting Booth** 

Metal Finishing Machines
Rotary Dryers
Shot Blasting
Vibratory Finishing Machines
Polyamide (Glide) Coating
Zinc Plating Plants
Material Handling System
Flocking Units
Electric Oven
Industrial Oven
Plating Barrel
Servo Stabilizer

18. PLANT LAYOUT AND PROCESS FLOW SHEETS

# **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.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

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.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India.

Email: npcs.india@gmail.com Website: NIIR.org