The Complete Book on Production of Automobile Components & Allied Products

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The Complete Book on Production of Automobile Components & Allied Products (Engine Parts, Piston, Pin, Piston Ring, Valve, Control Cable, Engine Mounting, Auto Lock, Disc Brake, Drum, Gear, Leaf Spring, Shock Absorber, Silencer, Chain, Cylinder Block, Chassis, Battery, Tyre & Flaps)

The rapid urbanization, coupled with an overwhelming growth in the middle class population, has created a market that is extremely conducive for the automobile industry to flourish. It is inferred from the demand, the investment in the automobile industry is estimated at over hundredths of billions in the vehicles and auto components segment. The auto market is thought to be made primarily of automakers, but auto parts makes up another lucrative sector of the market. The major areas of auto parts manufacturing are: Original Equipment Manufacturers (OEMs) - The big auto manufacturers do produce some of their own parts, but they can't produce every part and component that goes into a new vehicle; Replacement Parts Production and Distribution - These are the parts that are replaced after the purchase of a vehicle. The book provides a characterization of vehicles, including structure, load, fuel used, requirement of various components, fabrication and so on. It will prove to be a layman's guide and is highly recommended to entrepreneurs, existing units who wants to diversify in production of automobile and allied products, research centers, professionals and libraries, as it contains information related to manufacturing of integral parts of an automobile and practices followed in the finishing of the products.

The topics covered in the book are: Classification of vehicles on the basis of load, fuel used and their parts; Material used in the manufacturing of automobile (Metals, Alloys, Polymers etc.); Technology used; Use of Aluminium in Automobiles; Use of Plastics in Automobiles; Manufacturing practices for Engine Parts(Auto Piston, Pins, Piston ring, Lead Storage Battery, Valve & Valve Seat, Automobile Silencer, Automobile Chain, Cylinder Block, Automobile Control Cable, Engine Mounting PAD, Auto Locks etc.); Manufacturing of Automobile Chassis, Disc Brake, Brake Drum, Gear, Gear Blank, Leaf Spring, Shock Absorbers, Automobile Tyres; Heat Treatment System for Automobile Parts; Forging Technology (Open Die Forging Process, Close Die Forging Process, Designing of forged parts) and Painting Technology(Conversion Coating, NAD Finishes, Aluminium Flake Orientation, Opacity, Gloss, Electro Powder Coating, Spot Repair, Electrostatic Spray etc.) for automobile parts; Scab Corrosion Test, Peel Resistance.

Classification of Vehicles

On the Basis of Load

Wheels

Fuel Used

Body

Transmission

Position of Engine

Engine in Front

Engine in the Rear Side

Layout of an Automobile Chasis

Components of the Automobile

Functions of Major Components of an Automobile

Chasis and Frame

Engine or Power Plant

Transmission System (Clutch and Gear Box)

Clutch

Final Drive

Braking System

Gear Box

Steering System

Front Axle

Suspension System

2. MATERIALS USED IN AUTOMOBILES

Introduction

Requirements of the Materials in Automotive

Lightweight

Cost

Safety, Crashworthiness

Crashworthiness Tests

Frontal Offset Crash Test Details

Side Impact Crash Testing/Ratings Criteria

Rollover Evaluations

Recycling and Life Cycle Considerations

Current Materials in Use and Their Future

Metals

Steel

New Grades of Steel and Alloys

a. Duplex Austenitic-ferritic Stainless Steel

b. Austenitic Stainless Steel

Advances in Manufacturing and Joining Technique

Aluminium

Aluminium Alloys for Body-in-white Applications

Aluminium Alloys for Brazing Sheet Applications

Magnesium

Mechanical Properties of Mg Alloys

Technical Problems and Solutions for Use of Magnesium Alloys in Automotive Industry

Plastics and Composites

Fabrication

Cost

Manufacturability

Design Data/Test Methodologies

Joining and Inspection

Renewable Materials, Barriers and Incentives in Use of Biocomposites

Thermoplastic/Thermoset Polymers

Composite Processing

3. MATERIALS AND TECHNOLOGY FOR

AUTOMOBILES

Introduction

Steel Sheets

High Strength Steel Sheets

New Precipitation-hardened High Strength Hot Rolled Steel Sheet "NANO-Hiten"

New High Strength Hot Rolled Steel Sheet for Strain Aging Use "BHT"

High Strength Galvannealed Steel Sheets

(1) SFG Hiten

(2) Low Carbon Equivalent Type Hiten

High Formability Ultra-high Strength Cold Rolled steel Sheets

High Carbon Steel Sheets with High Formability

Coated Steel Sheets

Coated Steel Sheets with High Lubrication for Automotive Use

- (1) Development of Inorganic Type High Lubrication Galvannealed Steel Sheets
- (2) Organic Solid Lubricant Technology
- (3) Summary

Hot Dip Galvanized Steel Sheet with Excellent Surface Appearance

- (1) Improvement of Surface Appearance
- (2) Surface Roughness Transfer Technologies and Frictional Properties
- (3) Summary

Evaluation and Application Technologies for Automotive Steel Materials

Tailor Welded Blanks

Application Technologies of Hydroforming

Application Technologies for High Strength Steel Sheets in Press Forming

Application of CAD-CAE Systems

High Frequency Electrical Materials for Cars of the Future "Super-Core"

Features of JFE Steel's Super-Core

JNEX

JNHF

Automotive Applications

Stationary Equipment

Rotating Machinery

Other Electrical Applications

Summary

Ferritic Stainless Steels for Automobile Exhaust System Parts

Steels for Mufflers

Steels for Exhaust Manifolds

Steels for Catalytic Converter Substrate

Steel Tubes

HISTORY Tube

High Formability ERW Tubes for Automotive Use

Stainless Steel Tubes for High Temperature Service in Automotive Exhaust Systems

Bar Products for Automotive Use

Bearing Steels "NKJ", "KUJ7"

Graphite Steel "HFC1 Steel"

BN Free Cutting Steel "CCBN Steel"

High Surface Durable Carburized Dual-phase Steel

High Toughness Microalloyed Steel for Hot Forging

Warm Compaction Method with Die Wall Lubrication for Iron Powder Metallurgy

Lightweight Composite Material for Automotive Headliner "KP Sheet"

4. USE OF ALUMINIUM IN AUTOMOBILES

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Aluminium in Automobile

Advantages

Disadvantages

Space Frame Technology

Sand Casting

Al-Si Alloys

Grain Refinement

Modification

Extrusion

Al-Si-Mg Alloys

Moment of Inertia

Heat Treatment

Solutionizing

Aging

Annealing

Exposed Loads on Chassis

Static Loads

Dynamic Loads

Fatigue

Welding

Stress Corrosion Cracking

Sand Casting

Spiral Fluidity Test

Mechanical Properties of A356.0 and Silafont - 36

Mechanical Properties Change with Heat Treatment

5. USE OF PLASTICS IN AUTOMOBILES

Technology Activities and Priorities

6. MANUFACTURING OF ENGINE PARTS

1. Manufacturing of Auto Piston

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Market Potential

Basis and Presumptions

Implementation Schedule

Preparation of Project Report

Technical Aspects

Process of Manufacture

Quality Control and Standards

Production Capacity

Pollution Control

2. Manufacturing of Pins for Automobiles

Introduction

Market Potential

Production Target (per Annum)

Basic & Presumptions

Implementation Schedule

Technical Aspects

3. Manufacturing of Piston Ring

Introduction

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects Material **Quality Control Pollution Control** Introduction

Manufacturing Process

Piston Ring Coatings

Power Consumption

4. Manufacturing of Lead Storage Battery

Market Potential

Basis & Presumptions

Implementation Schedule

Technical Aspects

I. Process of Manufacture

Process Flow Chart

II. Quality Control & Standard

III. Production Capacity (Per Annum)

IV. Motive Power Required

V. Pollution Control Requirements

VI. Energy Conservation

Lighting

Additional Information

5. Manufacturing of Valve and Valve Seat

Introduction

Methodology

Material Selection

Exhaust Valve

Criteria of Exhaust Valve

Chemical Analysis

Mechanical Properties

Physical Properties

Exhaust Valve Seat Insert

Criteria for Material Selection of Engine Valve Seat Insert

Extrusion

Process Selection

Exhaust Valve

Flow Processes

Friction Welding

Upsetting

Steps

Forging

Heat Treatment

Advantages

Steps

Stellite Deposition

Advantages

Head Diameter Facing

Groove CNC Turning

Tip Hardening

Advantages

Neck Profile Turning

Seat Grinding

Surface Finishing

Advantages

Alternative Process

Alternative Process

Exhaust Valve Seat Insert

Flow Processes

Investment Casting

Steps

Surface Finishing

Steps

Wear Resistance Treatment

Ferritic Nitrocarborizing

Advantage

Steps

6. Manufacturing of Automobile Silencer

Introduction

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

Quality Control and Standards

Pollution Control

Energy Conservation

7. Manufacturing of Automobile Chain

Introduction

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

Quality Control and Standards

Production Capacity (per annum)

Pollution Control

Energy Conservation

8. Manufacturing of Cylinder Block

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Description of the Product

What is an Engine Block?

Functional Requirements of a Cylinder Block

Required Material Properties

Metals Used in the Manufacture of the Cylinder Blocks

Manufacturing the Cylinder Block

Mechanical Properties of the Alloys

Gray Cast Iron Alloys

Compacted Graphite Cast Iron

Aluminium Alloys

Magnesium Alloys

Casting Processes

Green Sand Molding

Lost Foam Casting

Market Potential

Basis and Presumption

Implementation Schedule

Technical Aspect

Manufacturing Process

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Quality Control and Standards

Utilities

Energy Conservation

Pollution Control

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Production Capacity: 45000 Per Annum

Market & Demand Aspects

Manufacturing Process & Source of Technology

Basis of Project Preparation and Technical Aspects

Presumption

Implementation Schedule

Quality Control & Standards

Pollution Control

10. Manufacturing of Automobile Control Cable

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Basis and Presumptions

Technical Aspects

Process of Manufacture

Implementation Schedule

Process Flow Chart

Quality Control and Standards

Motive Power

Pollution Control

11. Manufacturing of Engine Mounting PAD

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Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

12. Manufacturing of Auto Locks

Project Profile on Casting for Auto Locks

Part - II

Introduction

Market Potential

Basis & Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

Quality Control and Standards

Pollution Control

Energy Conservation

7. MANUFACTURING OF AUTOMOBILE CHASSIS

1. Manufacturing of automobile Body

Automobile Body Manufacturing Processes

BIW Manufacturing Processes

Blanking and Stamping Processes

Subassembly Processes and Major subassemblies of a BIW

Body Framing Process

Door Manufacturing Processes

Rolling and Blanking Processes

Stamping Process

Door Hanging and Fitting Process

Door Hanging Process

Door Fitting

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

Pollution Control

Energy Conservation

2. Manufacturing of Disc Brake

Introduction

Grey Cast Iron as Material for Production of Disc Brake

Aluminium as the Material for the Holder

Manufacturing Process of DISC Brake and Holder

Cold Chamber

Hot Chamber

Heat Treatment for Holder

- i. Cooling Rate
- ii. Shrinkage
- a. Volumetric Shrinkage
- b. Linear Shrinkage

Finishing Process

Driving the Lathe

Holding and Rotating the Work

Holding, Moving and Guiding the Cutting Tool

For Disc Brake

For the Holder

Methodology

Summary

3. Manufacturing of Brake Drum

Introduction

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

Quality Control and Standards

Production Capacity (per annum)

Pollution Control

4. Manufacturing of Gear Blank

Introduction

Market and Demand Aspects

Raw Materials

Manufacturing Process

The Process of Flow Chart

5. Manufacturing of Gear

Introduction

Materials Used in Gear Manufacturing Process

Classification of Gears

- 1. Milling Process
- 2. Gear Planning Process
- 3. Gear Shapers
- 4. Gear Hobbing
- 5. Bevel Gear Generating

Gear Manufacture by Casting Method

Methods of Forming Gears

Roll Forming

Stamping

Powder Metallurgy

Extrusion

Gear Generating Process

Gear Hobbing

Type of Hobbing

Arial Hobbing

Radial Hobbing

Tangential Hobbing

Gear Shaping (The Fellows Process)

Rack - Type Cutter Generating Process

Pinion Type Cutter Generating Process

Advantages

Disadvantages

Gear Cutting by Milling

Disc Type Cutter

End Mill Cutter

Advantage

Used

Bevel Gear Generating

Straight Bevel - Gear Generator

Spiral Bevel - Gear Generator

Gleason Method

Templet Gear Cutting Process

Gear Finishing Process

Gear Shaving

Gear Grindings

Disadvantage

Gear Lopping

Shot Blasting

Phosphate Coating

Gear Planning

The Sunderland Process

The Maag Process

Principal of Gear Planning

6. Manufacturing of Gear Box Housing

Introduction

Market Potential

Basis & Presumptions

Implementation Schedule

Technical Aspects

- a. Production Details and Process of Manufacturing
- b. Quality Control & Standards

Process Flow Graphic Representation

Pollution Control

Energy Conservation

7. Manufacturing Process of Leaf Spring

Introduction

History of Leaf Spring

Construction of Leaf Spring

Standard Size of Automobile Suspension Spring

Material Used in Leaf Spring

Basic Characteristics of Spring Materials

Mechanical Properties of Leaf Spring

Manufacturing of Leaf Spring

Shearing

Main Eye Rolling

Tapering

Drilling

Hardening

Tempering

Hardness Test

Shot Peening

Market Potential

Implementation Schedule

Technical Aspects

A. Production Details and Process of Manufacture

B. Quality Specification

Process Flow Chart

Pollution Control Measures

Energy Conservation

8. Manufacturing Process of Shock Absorbers

Historical Development of Shock Absorbers

Adoption of Hydraulic Telescopic Dampers

Non-pressurised Twin Tube Telescopic Hydraulic Dampers

Gas Charged Shock Absorbers

i. Mono-tube Shock Absorbers

ii. Twin Tube Pressurised Shock Absorbers

Spring Assisted Dampers

Structure of Industry, Ownership Pattern & Installed Capacity

Geographical Distribution of Shock Absorber Manufacturers

Raw Materials, Semi-finished Components Used & Their Sources of Supply

Major Imports of Raw-materials to Sustain Indigenous Production

Manufacturing Processes & Machines Generally Used

9. Manufacturing Process of Automobiles Tyres

Tyre - Modern Vehicle Design Elements

Front-wheel Drive

Powerful Brakes

Power Steering

'Hot Hatches'

Diesel Engines

How to Make a Tyre

Raw Material Tyre Components

Chemicals

Textiles

Components

Natural Rubber

Steel

Tyre Construction

The Compound

Primary Processing

Extruding

Coating

Calendering

Stages in Building a Tyre

Stage 1 - Flat Forming

Stage 2 - Shaping

Stage 3 - Moulding the Tyre

Stage 4 - Finishing and Inspection

Tyre Trouble

Problems Caused by Under Inflation

The Dangers of Overloading

The Effects of High Speed Travel

Tyre Technology

Striking the Balance

Better Performance

Correct Tyre Fitment

Fitting the Right Tyre

Specifically for Taxi Tyres

Dunlop Taxi Tyres

Dunlop's Classic Tyre Range

How to Fit Tyres Correctly

Specialist Wheel Types

Valves

Tubes

4 x 4 Tyres

Fitment of Radial Winter Tyres

Retread Tyres

Sidewall Markings

The Meaning of Sidewall Markings

Tyre Construction

Major Components

Cross (Bias) - and Radial-ply Tyre Features

Characteristics

Ride Comfort

Acceleration and Braking

Cornering

Tyre Life

Fuel Consumption

Initial Cost

Tyre Material

Natural and Synthetic Rubbers

Natural Rubber (NR)

Chloroprene (Neoprene) Rubber (CR)

Styrene-butadiene Rubber (SBR)

Polysoprene Rubber (IR)

Ethylene Propylene Rubber (EPR)

Polybutadiene Rubber (BR)

Isobutene-isoprene (Butyl) Rubber (IIR)

Tyre Tread

Tread Bite

Tread Drainage Grooves

Tread Ribs

Tread Blocks

Tread Slits or Sips

Selection of Tread Patterns

Normal Car Tyres

Wet Weather Car Tyres

Truck Tyres

Off on Road Vehicles

Tyre Profile and Aspect Ratio

Tyre Manufacturing

Tyre Sizes and Designations

Construction Type

Speed Marking of Tyres

Size

Casing Profile

Related Topics

Nanotechnology in Automotive Tyres

The Drivers for Better Tyres

What Nano-enabled Functionalities can Offer

Impact

Economic/Industry

Impact on European Citizen

Challenges

Environment, Health & Safety

Transport: Nanotechnology in Automotive Tyres

EU Competitive Position

Summary

10. Manufacturing of Auto Tubes and Flaps

Introduction

Market Potential

Basis and Presumptions

Implementation Schedule

Technical Aspects

Process of Manufacture

8. HEAT TREATMENTS OF AUTOMOBILES

Introduction

Materials Used in Autovehicles

Bake Hardening Steel Sheets

High Tensile Strength Steel Sheets

Corrosion Resistant Coated Steel Sheets

Constructional Steels

Case Hardening Steels

Heat Resistant Steels

Powder Metallurgy Products

Non-ferrous Alloy Powder Metallurgy Products

Copper Alloys

Aluminium Alloys

Magnesium Alloys

Titanium Alloys

Composite Materials

Plastics and Rubber

Glass and Ceramics

Heat Treatment

Types of Heat Treatment

Processing Technology in Heat Treatment

Carburizing and Carbonitriding

Nitro-carburizing

Induction Hardening

Powder Metallurgy and Sintering

Key Issue in Heat Treatment: Atmosphere Control

Carbon Potential Control

Gas Carburizing Processes

Reduced Pressure Carburizing (Vacuum Carburizing)

High Pressure Gas Quenching

Carbonitriding

Low Temperature Nitrocarburizing and Oxy-nitro-carburizing

Surface Modification and Hybrid Heat Treatment

Solid Lubricant Coatings

Emerging Technologies in Materials, Heat Treatment and Surface Engineering

Materials

Carburizing and Carbonitriding

New Nitriding Methods for Aluminium

Nitriding of Stainless and Maraging Steels

Furnaces for Heat Treatment of Fasteners and Automobile Parts

Specifications of the Line

Washing Machine

Hardening Furnace

Quenching Tank

Continuous Hot Blast Tempering Furnace

Double Layer Dyeing Tank

Capacity of the Main Furnace

Crucible Type Annealing Furnaces

Application

Features

Specifications of the Bell Type Furnace

Features

Capacity of the Quenching Tank

Capacity of the Continuous Hot Blast Tempering Furnace

Capacity of the Dyeing Tank

9. FORGING TECHNOLOGY OF AUTOMOBILE

PARTS

Introduction

Features of Forgings Peculiar to Automobile

Types of Forging Processes

Open Die Forging Process

Close Die Forging Process

Steps for the Design of Forged Part

Parting Line

Draft Angles

Fillet and Corner Radii

Machining Allowances

Forging Tolerances

Shapes for Forging

Die Design Parafeitrs

Flash Land and Flash Gutter Design

Trimming Die Design

Hot Coining Die Design

Forging Equipments

10. PAINTING TECHNOLOGY OF AUTOMOBILES

Introduction

Spray Priming System

Dip Priming System

Electropriming System

Performance

Pretreatment

Rust Removal

Alkali Degrease

Metal Phosphate (Conversion Coating)

Pretreatment as a Corrosion Inhibitor: Mechanism

Priming

Spray Priming

Dip Priming

Products

Pigmentation

Process

Electropainting

Anodic Electrocoat

Resin Systems

Pigmentation

Practical Considerations

Basic Plant Requirements

Control Methods

Deficiencies of Anodic Electrocoat Primers

Cathodic Electrocoat

Resin System

Pigmentation

Colour

Mechanism of Deposition

Performance Characteristics

Plant Requirements

Dip Rinsing

Ultrafiltration

Control Method

Pretreatment

General Appraisal and Current Developments

Surfacers

Background

Introduction

Product Types and Formulation

Resins Systems

Alkyds

Epoxy Esters

Polyesters

Epoxies: Film Modifiers

Crosslinking Resins

Pigmentation

Prime Pigments

Extenders

Polyurethane-modified polyester surfacer (including 'colour keyed' products)

Summary of Basic Parameters

Film Properties (Stoved Film)

Anti-chip Coatings

Background and Resin Types

Pigmentation

Inverted or Reverse Process

Electro Powder Coating (EPC)

Automotive Topcoats

Alkyd or Polyester Finishes

Basic Chemistry

General Properties

Thermosetting Acrylic/NAD Finishes

Basic Chemistry

General Properties

Metallic Appearance

'Sagging'

'Solvent-popping' Resistance

Thermoplastic Acrylic Lacquers

Basic Chemistry

General Properties

Basecoat/clear Technology

Solvent-borne

Basic Chemistry

Application/Process

Colour/Pigmentation

Aluminium Flake Orientation

Undercoats

Performance/Durability

Water-borne

Processing

Characteristics

Pigmentation of Automotive Topcoats

Solid Colours

Durability

Opacity/Gloss

Cost

Bleed

Metamerism

Use of Lead Chromate Pigments

'Single Coat' Metallics

Durability

Opacity/Gloss

Cost

Colour Matching

Choice of Aluminium Flake

Basecoat/Clear Metallics

Opacity

Cost

Colour Matching/Durability

Choice of Aluminium Flake

In-factory Repairs

Thermosetting Finishes (Panel Repairs)

Thermoplastic Acrylic Lacquers (Spot Repair)

Painting of Plastic Body Components

Sheet Moulded Compound (SMC) and Dough Moulded Compound (DMC)

Polyurethane: PU RIM and PU RRIM

Injection Moulded Plastics

Painting Problems

Adhesion

Heat Distortion

Surface Texture

Solvent Sensitivity

Degradation of Mechanical Properties

Paint Processes and Products

On-line

Off-line

'Part-way' Down Paint Line

Spray Application

Air Spray

Spray Losses

Automatic Spray

Low-pressure Hot Spray

Airless Spray

Electrostatic Spray

Electrostatic Spray—Metallic Appearance

Resistivity

'Interior' Application (Electrostatic Spray)

Electrostatic Application of Water-Borne Automotive Coatings

General Plant Design Features

Paint Circulating System for Electrical Insulation

Externally Charged Atomizers

Application Efficiency—Practical Considerations and Processes

Modern Spraybooth Design—Ventilation Modes

Preconditioning the Air

Concentrators

Process Details: Typical Application Parameters—Turbo Bells

Stoving Procedures

Oven Technology

Design Considerations of Convection Ovens

Oven Configuration

Oven Ventilation

Oven Heating

Fresh Air Requirements

Fuel Available/Heating Method

Fume and Odour Emission

Thermal Incineration

Catalytic Combustion

Future Stoving Developments

Performance/Testing

Appearance

Performance

Physical Properties

Chemical Resistance

Test Procedures

Cure (Test for Crosslinking Products)

Sandability (Surfacers)

Adhesion: Crosshatch Test (1.5mm or 2.0mm template)

Hardness

Stone-chip Resistance

Impact Test

Flexibility

Acid Resistance

Alkali Resistance

Acid and Alkali Resistance (Alternative Procedure)

Water Immersion (Continuous)

Humidity Resistance (Continuous)

Scab Corrosion Test

Florida Exposure (5° South)

Peel Resistance: Florida 5° South

Accelerated Weathering

Future Developments

High Solids Technology

Higher Solids Surfacer Technology

High Solids Polyester Topcoats

Higher Solids Basecoats

Ultra High Solids Coatings

Water-Borne Products

Surfacers

Basecoats

Powder Coatings and Aqueous Slurries

Aqueous Powder Slurries

Solid Colour Basecoats

Clearcoats

Pigmentation

Painting of Plastics

Electrodeposition and Spray Application

About NIIR

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