

Polymers and Plastics Technology Handbook

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Format: paperback

Code: NI84

Pages: 424

Price: Rs.750US\$ 100

Publisher: NIIR PROJECT CONSULTANCY SERVICES

Usually ships within 5 days

Plastics play a very important role in our daily lives. Throughout the world the demand for plastic, particularly plastic packaging, continues to rapidly grow. Polymer technology deals with the manufacture and production of polymer and synthetic substances. Plastic is incredibly versatile and can be made from different ingredients, moulded into any shape, and put to a huge range of uses across industry and the rest of society, from carrier bags to electrical cables. Polymer energy system is an award winning, innovative, proprietary process to convert waste plastics into renewable energy. Some of the important example of polymers and plastics are polytetra fluoroethylene (PTFE), polyether sulphone (PES), phenol-formaldehyde (PF), polyolefins, vinyl polymers, thermoplastic polyesters, polysulfones, poly(phenylene sulfide), etc. Polymers are the most rapidly growing sector of the materials industry. The Indian plastic industry has taken great strides. In the last few decades, the industry has grown to the status of a leading sector in the country with a sizable base. The material is gaining notable importance in different spheres of activity and the per capita consumption is increasing at a fast pace. Continuous advancements and developments in polymer technology, processing machineries, expertise, and cost effective manufacturing is fast replacing the typical materials in different segments with plastics. On the basis of value added, Indian share of plastic products industry is about 0.5% of national GDP.

The major contents of the book are properties and applications of speciality plastics, thermoset plastics, applications of recycle plastics, introduction of polymer science, polymer additives, blends and composites, commodity thermoplastics and fibres etc. This book also consists of raw material suppliers for plastic and plastic products, manufacturers of plastic, processing machinery, plastics processing machinery and equipment (foreign), machinery and equipment for plastic converting, extruders and extrusion lines, injection moulding machines, presses and accessories, blow moulding and thermoforming machines etc.

The book has been designed with the idea of blending and integrating basic polymer science and the technology of plastics into a composite structure. This book is an outcome of an endeavour in the direction of polymer and plastic processing. It would be of immense use to entrepreneurs, consultants, students and libraries etc.

1. PROPERTIES AND APPLICATIONS OF SPECIALITY PLASTICS

Polytetra Fluoroethylene (PTFE)

Characteristics

Applications

Thermoplastic Polyurethanes (TPU)

Characteristics

Applications

Polysulphones (PSO)

Characteristics

Applications

Polyether Sulphone (PES)

Characteristics

Applications

Polyphenylene Sulphide (PPS)

Characteristics

Applications

Polyphenylene Ether (PPE)

Characteristics

Applications

Polyether Etherketone (Peek)

Characteristics

Applications

Polyarylates

Characteristics

Applications

Polyamide-Imide (PAI)

Characteristics

Applications

Polyether-Imide (PEI)

Characteristics

Applications

Liquid Crystal Polymers (LCP)

Characteristics

Applications

2. PROPERTIES AND APPLICATIONS OF THERMOSET PLASTICS

Phenol-Formaldehyde (PF)

Characteristics

Applications

Amino Plastics

Characteristics

Applications

Melamine Formaldehyde

Urea Formaldehyde

Epoxy Resins

Characteristics

Applications

Unsaturated Polyester Resins

Characteristics

Applications

Polyurethane

Characteristics

Applications

Silicones

Silicone forms

Characteristics

Applications

Silicone fluids

Silicone Resins

Silicone Elastomers

3. APPLICATIONS OF RECYCLED PLASTICS

Introduction

Recycled LDPE

Recycled HDPE

Recycled Polypropylene

Recycled PVC

Recycled PS

Recycled PET

Recycled Commingled Plastics Waste

4. INTRODUCTION TO POLYMER SCIENCE

Classification of Polymers

Thermoplastics and Thermosets

Classification Based upon Polymerization Mechanism

Classification Based upon Polymer Structure

Polymer Structure

Copolymers

Tacticity

Geometric Isomerism

Nomenclature

Molecular-Weight Distribution

Molecular-Weight Averages

5. POLYMER ADDITIVES, BLENDS AND COMPOSITES

Additives

Plasticizers

Fillers and Reinforcements

Other Important Additives

Polymer Blends

Interpenetrating Networks

Mechanical Properties

Composite Fabrication

Reference

6. COMMODITY THERMOPLASTICS AND FIBERS

Thermoplastics

Polyolefins

Vinyl Polymers

Thermoplastic Polyesters

Fibers

Natural and Synthetic Fibers

Cellulose

Noncellulosics

Fiber-Spinning Operations

7. ENGINEERING AND SPECIALTY POLYMERS

Engineering Plastics

Polyamides

ABS

Polycarbonates

Modified Poly(phenylene oxide)

Acetal

Polysulfones

Poly(phenylene sulfide)

Engineering Polyesters

Fluoropolymers
Specialty Polymers
Polyimides and Related Specialty Polymers
Ionic Polymers
Polyaryletherketones
Specialty Polyolefins
Inorganic Polymers
Liquid-Crystal Polymers
Conductive Polymers
High-Performance Fibers
Other Specialty Polymers
8. POLYMER PROCESSING AND RHEOLOGY

Extrusion
Molding
Calendering
Coating
Non-Newtonian Flow
Viscosity of Polymer Solutions and Suspensions
Constitutive Equations
Elastic Properties of Polymeric Fluids
Pressure (Poiseuille) Flow
Drag Flow
Capillary Rheometer
Couette Rheometer
Cone-and-Plate Rheometer
Rheometric Characterization of Polymer Solutions and Melts
Introduction to the Modeling of Polymer-Processing
Operations: Extrusion
Appendices

9. COMPONENTS OF A THERMOPLASTIC STRUCTURAL COMPOSITE

Thermoplastic Matrix Resins
Chain Extendable Resins
Amorphous Thermoplastics
Orientable Polymer Matrices
Semi-crystalline Thermoplastic Polymers
Polymer Blends and Compounds
The 'Victrex' Range of Aromatic Polymers
This allows for easy crystallization of the
polyetherketone family.
Polyetheretherketone
Reinforcing Fibres
Organic Polymeric Fibres
Inorganic Filaments
Carbon Fibres
High Strength Carbon Fibres
Interfaces and Interphases
Wetting of the Fibre by the Resin
Chemical Bonding
Mechanical Interlocking
Crystalline Interactions
Thermoplastic Structural Composite Materials
10. PROCESSING SCIENCE AND MANUFACTURING

TECHNOLOGY

Processing Science

Chemical Change

Thermophysical Properties

Rheology

The Analysis of Processing Operations

Manufacturing Technology

Consolidation

Continuous Consolidation

Tape Placement

Continuous Forming

Stamping

Diaphragm Forming

Incremental Processing

Machining

Assembly Technologies

Fasteners

Adhesive Bonding

Solvent Bonding

Fusion Bonding

Interlayer Bonding

Rework, Repair and Reclaim

Quality in Processing

11. DIRECTORY

Raw Material Suppliers for Plastic and Plastic Products

Manufacturers of Plastic Processing Machinery

Plastics Processing Machinery and Equipment (Foreign)

Machinery and Equipment for Plastic Converting

Extruders and Extrusion Lines

Injection Moulding Machines

Presses and Accessories

Blow-Moulding and Thermoforming Machines

Machinery for converting Reaction Resins

(Unsaturated Polyesters, Epoxies)

Coating Lines

Other Plastics Converting Machines

Miscellaneous Plastic Machineries

About NIIR

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Thu, 01 May 2025 13:31:38 +0000