

# Polymers and Plastics Technology Handbook

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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

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