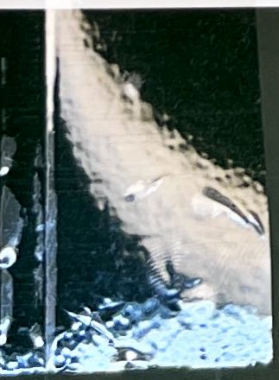
Industrial Polymers, Specialty Polymers, and Their Applications

Plastics Engineering Series



Manas Chanda
Salil K. Roy

CRC Press
Taylor & Francis Group

Industrial Polymers, Specialty Polymers, and Their Applications

Industrial Polymers, Specialty Polymers, and Their Applications

Manas Chanda
Salil K. Roy

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

Contents

Preface

The polymer industry consumes more than half of the total output of the organic chemical industry, but only a few polymers account for most of it. For example, the combined output of polypropylene, high-density polyethylene, and linear low-density polyethylene, all produced by polymerization with transition-metal catalysts, was responsible for 42% of the 41 million metric tons of thermoplastic resins produced in the United States in the year 2000, while another 40% represented a handful of polymers that are produced using a free-radical mechanism, namely, low-density polyethylene, poly (vinyl chloride), polystyrene, poly(vinyl alcohol), poly(methyl methacrylate), and poly(vinyl acetate). Most of the remaining 18% corresponded to polyurethanes and a few condensation polymers, such as poly(ethylene terephthalate), poly(butylene terephtahalate), polyamides, and polycarbonates. Even the period from 2000 to 2005, which witnessed considerable stress and change in the U.S. chemical industry, did not cause any significant change in the landscape (Villa, C. M. 2007. *Ind. Eng. Chem. Res.*, 46, 5815–5823). In the present book, all these polymers are prominently discussed in Chapter 1, which also includes other less widely used polymer types such as acrylics, ether polymers, cellulosics, sulfide polymers, silicones, polysulfones, polyether ether ketones, and polybenzimidazoles. Polyblends and interpenetrating network polymers are also included in this chapter.

Besides the aforesaid industrial polymers, most of which we often encounter in everyday life, there are hundreds of other polymers, polymer derivatives, and polymeric combinations that play special and often critical roles in diverse fields of human activities. Chapter 2 deals with such polymers. Some of these *specialty polymers* possess, inherently, one or more special properties that make them indispensable for specific applications, while there are many others that are tailor-made or made by modification of the aforesaid industrial polymers to meet specific and critical needs. For a systematic discussion, these polymers can be placed in different groups according to their properties and/or areas of uses, such as high-temperature and fire-resistant polymers, liquid crystal polymers, electroactive polymers, electrolytic polymers, photoresist polymers, ionic and ion-exchange polymers, packaging polymers, biodegradable polymers, adhesive polymers, polymers in optical information storage, polymeric sensors, conductive fiber fillers, polymeric optical fibers, polymer electrolyte membranes, biodegradable polymer scaffolds, scavenger resins, permselective polymer membranes, hydrogels, smart polymers, dendritic polymers, shape memory polymers, microencapsulation polymers, polymer nanocomposites, wood–polymer composites, and polymerization-filled composites.

As we live in a plastic age, the diverse fields of plastics technology are also undergoing rapid change both qualitatively and quantitatively with many newer applications of common polymers and specialty polymers coming to light. While there are continuous improvements in the established uses of polymers, new uses are being developed in such diverse areas as the automotive and aerospace industries, packaging, agriculture, horticulture, domestic and sports appliances, office equipment,

communication, electronics and electrical technology, and biomedical applications. Chapter 3 presents a comprehensive overview of new developments in polymer uses in all these areas.

The material in this book is included in our well-known *Plastics Technology Handbook* and it focuses on a wide range of polymers, both of common and special types, and their myriad applications. For readers who are not quite familiar with polymers and their characteristics, it would be advisable to read *Plastics Fundamentals, Properties, and Testing*, before taking up the present book. We thank Allison Shatkin, Materials Science and Chemical Engineering Editor at CRC Press/Taylor & Francis, who first conceived the idea of this book and took the initiative in publishing it.

Manas Chanda
Salil K. Roy