

A Volume in the Plastics Design Library Series

Manufacturing and Novel Applications of Multilayer Polymer Films

Deepak Langhe, Michael Ponting

As multilayer technology has advanced, it has become possible to produce hundreds of layers in a single film by a melt coextrusion process. These engineered films can have significantly enhanced performance properties, allowing films to be made thinner, stronger, and with better sealing properties.

The potential performance benefit of multilayer technology means that there is a great deal of interest, especially in improving energy and data storage. This book is the first comprehensive summary of the latest technology in multilayered film processing and related applications. It is written from a practical perspective, translating research into commercial production, and real-world products.

There are multiple aspects of coextrusion processing, which need to be considered by engineers and scientists working in this area, involving different feedstocks and material considerations. Multilayer coextrusion processing technology is reviewed, including how to fabricate such structures, as well as structure and properties of microlayers. This book helps research scientists and engineers to develop products that not only fulfill their primary function, but can also be manufactured reliably, safely, and economically. Future trends in multilayer coextrusion technology are also thoroughly assessed, enabling readers to stay ahead of the curve in this rapidly advancing area.

ABOUT THE AUTHORS

Deepak Langhe is a Technology Director at PolymerPlus LLC where he serves as a senior scientist and primary investigator on micro- and nanolayer-based film technologies. Deepak received his PhD from Case Western Reserve University's Department of Macromolecular Science and Engineering under Professors Eric Baer and Anne Hiltner. He has more than 20 publications and 2 issued patents related to innovative applications of multilayer film systems and structure-property relationships of multilayered polymer films.

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Manufacturing And Novel Applications Of Multilayer Polymer Films

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Manufacturing And Novel Applications Of Multilayer Polymer Films:

Manufacturing and Novel Applications of Multilayer Polymer Films Deepak Langhe, Michael Ponting, 2016-01-04

Manufacturing and Novel Applications of Multilayer Polymer Films discusses the advancements in multilayer technology including its capability to produce hundreds of layers in a single film by a melt coextrusion process. These engineered films can have significantly enhanced performance properties allowing films to be made thinner, stronger, and with better sealing properties. As recent developments in feedblocks and materials have opened up a range of new possibilities, this book discusses different feedblocks and viscosity and material considerations. It is the first comprehensive summary of the latest technology in multilayer film processing and related applications and is written from a practical perspective translating research into commercial production and real world products. The book provides fundamental knowledge on microlayer coextrusion processing technology, how to fabricate such structures, structure and properties of such microlayers, and potential applications, thus helping research scientists and engineers develop products which not only fulfill their primary function but can also be manufactured reliably, safely, and economically. Provides a fundamental knowledge of microlayer coextrusion processing including how to fabricate microlayer structures, the properties of microlayers, and potential applications including optics, polymer film capacitors, and semiconductors. Includes an in-depth analysis of all technologies used for producing multilayered films and structures by coextrusion processing. Thoroughly assesses potential future trends in multilayer coextrusion technology, thus enabling engineers and scientists to stay ahead of the curve in this rapidly advancing area.

Polyester Films Miko Cakmak, Jehuda Greener, 2023-07-25. This volume presents a comprehensive review of key aspects of polyester film technology ranging from first principles to practical applications. Bringing together world class experts to review the state of the art of key materials and processing elements of polyester film technology, *Polyester Films* covers a wide range of topics with direct utility to students, practitioners, business managers, and researchers in academia and industry. Topics covered in this volume include survey of optical and physical properties, microlayer coextrusion, polyester ionomers, polyester blends, biomedical applications, and recycling. In particular, the text focuses on novel design and application of polyester films such as those used in the production of flat panel displays, flexible electronics, and barrier films. The overriding objective of the book is to scope the multitude of options available to material and product designers in manipulating the properties of polyester films to meet specific performance and product criteria. These options include synthetic modifications, copolymerization, physical enhancements, blending, and process upgrades, tenter frame changes, coextrusion, and coating. Edited by two highly qualified material scientists with extensive experience in academia and industry, *Polyester Films* covers topics such as: Historical review of polyester film technology; Overview of physical performance and applications of key polyester films, especially PET and PEN; Synthetic options available for manipulating the structure and properties of polyesters, with special focus on polyester ionomers; Main blending options available to enhance the

performance of commodity polyesters Rheo optical properties of polyester films and corresponding testing methodology Micro layer coextrusion technology as applied to modify the performance of polyester films Bio medical applications Polyester recycling with special focus on upcycling With an interdisciplinary approach covering the performance of real life products and components Polyester Films is an essential resource for researchers and engineers in academia and industry working in physics material science chemistry and process engineering This volume should also be invaluable for graduate students and early career researchers in similar fields

Multilayer Flexible Packaging John R. Wagner Jr.,2016-03-29 Multilayer Flexible Packaging Second Edition provides a thorough introduction to the manufacturing and applications of flexible plastic films covering materials hardware and processes and multilayer film designs and applications The book gives engineers and technicians a better understanding of the capability and limitations of multilayer flexible films and how to use them to make effective packaging It includes contributions from world renowned experts and is fully updated to reflect the rapid advances made in the field since 2009 also including an entirely new chapter on the use of bio based polymers in flexible packaging The result is a practical but detailed reference for polymeric flexible packaging professionals including product developers process engineers and technical service representatives The materials coverage includes detailed sections on polyethylene polypropylene and additives The dies used to produce multilayer films are explored in the hardware section and the process engineering of film manufacture is explained with a particular focus on meeting specifications and targets In addition a new chapter has been added on regulations for food packaging including both FDA and EU regulations Provides a complete introduction to multilayer flexible packaging assisting plastics practitioners with the development design and manufacture of flexible packaging for food cosmetics pharmaceuticals and more Presents thorough well written and up to date reviews of the current technology by experts in the field making this an essential reference for any engineer or manager Includes discussion and analysis of the latest rules and regulations governing food packaging

Electrical Conductivity in Polymer-Based Composites Reza Taherian,Ayesha Kausar,2018-11-30 Electrical Conductivity in Polymer Based Composites Experiments Modelling and Applications offers detailed information on all aspects of conductive composites These composites offer many benefits in comparison to traditional conductive materials and have a broad range of applications including electronic packaging capacitors thermistors fuel cell devices dielectrics piezoelectric functions and ferroelectric memories Sections cover the theory of electrical conductivity and the different categories of conductive composites describing percolation threshold tunneling effect and other phenomena in the field Subsequent chapters present thorough coverage of the key phases in the development and use of conductive composites including manufacturing methods external parameters applications modelling and testing methods This is an essential source of information for materials scientists and engineers working in the fields of polymer technology processing and engineering enabling them to improve manufacture and testing methods and to benefit fully from applications The book also provides industrial and academic

researchers with a comprehensive and up to date understanding of conductive composites and related issues Explains the methods used in the manufacture and testing of conductive composites and in the modeling of electrical conductivity Contains specialized information on the full range of applications for conductive composites including conductive adhesives or pastes Brings scientists engineers and researchers up to date with the latest advances in the field

Dielectric Polymer Materials for High-Density Energy Storage Zhi-Min Dang, 2018-06-13 Dielectric Polymer Materials for High Density Energy Storage begins by introducing the fundamentals and basic theories on the dielectric behavior of material It then discusses key issues on the design and preparation of dielectric polymer materials with strong energy storage properties including their characterization properties and manipulation The latest methods techniques and applications are explained in detail regarding this rapidly developing area The book will support the work of academic researchers and graduate students as well as engineers and materials scientists working in industrial research and development In addition it will be highly valuable to those directly involved in the fabrication of capacitors in industry and to researchers across the areas of materials science polymer science materials chemistry and nanomaterials Focuses on how to design and prepare dielectric polymer materials with strong energy storage properties Includes new techniques for adjusting the properties of dielectric polymer materials Presents a thorough review of the state of the art in the field of dielectric polymer materials providing valuable insights into potential avenues of development

Polylactic Acid Lee Tin Sin, Bee Soo Tueen, 2019-06-15 Polylactic Acid A Practical Guide for the Processing Manufacturing and Applications of PLA Second Edition provides a practical guide for engineers and scientists working in PLA and on the development of emerging new products The current market situation for PLA and biodegradable polymers is described along with applications across a range of market sectors In addition the mechanical chemical thermal rheology and degradation properties are included Updates include new chapters covering various processing methods as well as recycling methods and additives and processing aids New applications cover a range of products including 3D Printing and an environmental assessment including regulatory aspects The book is not only a useful introduction to this topic but also a practical readily applicable reference book that will support decision making in the plastics industry Presents an essential reference for engineers scientists and product designers considering switching to a sustainable plastic Covers the properties synthesis and polymerization of PLA along with processing techniques involved in fabricating parts from this polymer Includes critical new chapters on processing additives recycling and environmental considerations relating to PLA

Durability and Reliability of Polymers and Other Materials in Photovoltaic Modules Hsinjin Edwin Yang, Roger French, Laura Bruckman, 2019-06-14 Durability and Reliability of Polymers and Other Materials in Photovoltaic Modules describes the durability and reliability behavior of polymers used in Si photovoltaic modules and systems particularly in terms of physical aging and degradation process mechanisms characterization methods accelerated exposure chamber and testing module level testing and service life prediction The book compares polymeric

materials to traditional materials used in solar applications explaining the degradation pathways of the different elements of a photovoltaic module including encapsulant front sheet back sheet wires and connectors adhesives sealants and more In addition users will find sections on the tests needed for the evaluation of polymer degradation and aging as well as accelerated tests to aid in materials selection As demand for photovoltaics continues to grow globally with polymer photovoltaics offering significantly lower production costs compared to earlier approaches this book will serve as a welcome resource on new avenues

The Science and Technology of Flexible Packaging Barry A. Morris, 2022-07-23 The Science and Technology of Flexible Packaging Multilayer Films from Resin and Process to End Use Second Edition provides a comprehensive guide on plastic films in flexible packaging covering scientific principles materials properties processes and end use considerations Sections discuss the science of multilayer films in a concise and impactful way presenting the fundamental understanding required to improve product design material selection and processes In addition the book includes information on why one material is favored over another and how film or coating affects material properties Descriptions and analysis of key properties of packaging films are provided from engineering and scientific perspectives With essential scientific insights best practice techniques environmental sustainability information and key principles of structure design this book provides information aids in material selection and processing how to shorten development times and deliver stronger products and ways to enable engineers and scientists to deliver superior products with reduced development time and cost Provides essential information on all aspects of multilayer films in flexible packaging including processing properties materials and end use Bridges the gap between scientific principles and practical challenges Includes explanations to assist practitioners in overcoming challenges Enables the reader to address new challenges such as design for sustainability and eCommerce

Fluoropolymer Additives Sina Ebnesajjad, Richard Morgan, 2019-04-15 Fluoropolymer Additives Second Edition provides practical information on this group of additives along with their applications and proper and safe handling Chapters cover how commercial additives have been updated providing a starting point where readers can begin the process of selection of additives for their own applications Fully updated sections on applications provide the readers with a step by step description of the techniques necessary to select and incorporate these additives in various products This book is the only practical guide available on the selection and use of fluoropolymer additives It will help readers optimize existing fluoropolymer applications and implement new initiatives In recent years the application of fluoropolymer additives has expanded significantly with even the meaning of fluoropolymer additives expanding from the relatively narrow definition of PTFE powder fillers to a wide variety of fluoropolymer elastomers used as processing aids for plastics processing techniques in extrusion injection molding and film blowing In addition fluoropolymer additives are being increasingly used in inks lubricants and coatings Includes essential information and data that enables engineers and materials scientists to realize the full benefits of fluoropolymer additives as processing aids Written by authors

Ebnesajjad and Morgan who take a highly practical approach to the subject that is based on real world experience and case studies Updated to include the latest commercial additives and applications information for practicing engineers

Plasticizers Derived from Post-consumer PET Ewa Langer,Krzysztof Bortel,Marta Lenartowicz-Klik,Sylvia Waskiewicz,2019-11-03 Plasticizers Derived from Postconsumer PET Research Trends and Potential Applications presents a roadmap to the successful use of postconsumer PET to obtain plasticizers for later use a proposal which presents both economic and sustainability advantages Based on the results of the latest research into the development of chemical recycling techniques of PET waste this book describes techniques where the plasticizer obtained can be utilized for value addition in PVC and other polymers In addition the book provides basic introductory information on the role of plasticizers in the modification of polymers basic quality requirements and the latest trends in the synthesis and use of plasticizers in industry also presenting the available methods of PET recycling with particular emphasis on chemical recycling analysis of the PET market the availability of postconsumer PET and its value as a raw material for other products Based on the authors research the book discusses the use of postconsumer PET in the synthesis of monomeric and oligomeric plasticizers Synthesis conditions are shown in detail and the influence of the structure of synthesized softeners on their basic quality parameters are assessed and compared with selected commercially available products In the final sections the book covers the economic challenges and benefits of this process and its application to newly developed products Presents a step by step introduction to the methods of recycling PET into usable plasticizers Provides a viable actionable alternative to landfills for postconsumer PET enabling the recycling of more waste polymer and reducing the carbon footprint of PET Analyzes the economic benefits and challenges of this process Compares the quality of the output to commercially available products

Phthalonitrile Resins and Composites Mehdi Derradji,Wang Jun,Liu Wenbin,2018-04-25 Phthalonitrile Resins and Composites Properties and Applications summarizes the latest research on these polymers providing information that enables materials scientists and engineers to deploy these polymers in the real world The book gives details on synthesis and preparation techniques for key phthalonitrile monomers All curing techniques are discussed along with blends and copolymers of phthalonitrile with other polymeric materials such as epoxy benzoxazine and bismaleimide Fiber and particle based phthalonitrile micro and nanocomposites are also discussed along with their potential applications in lightweight automobiles ships oil rigs aircraft wind blades high temperature bearings valves battery and electronic casings fire resistant textiles and more Introduces the subject of phthalonitrile polymers and their composites Provides precise information on the synthesis preparation and curing techniques for phthalonitrile polymers Discusses developments in key application areas that are intended to facilitate and stimulate real world applications of these materials

Recycling of Flexible Plastic Packaging Michael Niaounakis,2019-12-04 Recycling of Flexible Plastic Packaging presents thorough and detailed information on the management and recycling of flexible plastic packaging focusing on the latest actual potential methods and techniques and

offering actionable solutions that minimize waste and increase product efficiency and sustainability Sections cover flexible plastic packaging and its benefits applications and challenges This is followed by in depth coverage of the materials types and forms of flexible packaging Other key discussions cover collection and pre treatment volume reduction separation from other materials chemical recycling post processing and reuse current regulations and policies economic aspects and immediate trends This information will be highly valuable to engineers scientists and R D professionals across industry In addition it will also be of great interest to researchers in academia those in government or anyone with an interest in recycling who is looking to further advance and implement recycling methods for flexible plastic packaging Presents state of the art methods and technologies regarding the processing of flexible plastic packaging waste Addresses the challenges currently associated with both waste management and available recycling methods Opens the door to innovation supporting improved recycling methods manufacturing efficiency and industrial sustainability

The Effect of Sterilization on Plastics and Elastomers Laurence W. McKeen, 2018-02-22 The Effect of Sterilization Methods on Plastics and Elastomers Fourth Edition brings together a wide range of essential data on the sterilization of plastics and elastomers thus enabling engineers to make optimal material choices and design decisions The data tables in this book enable engineers and scientists to select the right materials and sterilization method for a given product or application The book is a unique and essential reference for anybody working with plastic materials that are likely to be exposed to sterilization methods be it in medical device or packaging development food packaging or other applications Presents essential data and practical guidance for engineers and scientists working with plastics in applications that require sterile packaging and equipment Updated edition removes obsolete data updates manufacturers verifies data accuracy and adds new plastics materials for comparison Provides essential information and guidance for FDA submissions required for new medical devices

Thermoplastics and Thermoplastic Composites Michel Biron, 2018-06-06 Thermoplastics and Thermoplastic Composites Third Edition bridges the technology and business aspects of thermoplastics providing a guide designed to help engineers working in real world industrial settings The author explores the criteria for material selection provides a detailed guide to each family of thermoplastics and explains the various processing options for each material type More than 30 families of thermoplastics are described with information on their advantages and drawbacks special grades prices transformation processes applications thermal behavior technological properties tenacity friction dimensional stability durability ageing creep fatigue chemical and fire behavior electrical properties and joining possibilities In this third edition standards and costs have been updated for all materials and more information on topics such as bioplastics 3D printing and recycling have been added In addition an entirely new chapter on the concept of Industry 4.0 has been added with guidance and suggestions on the incorporation of virtualization connectivity and automation into the plastics engineering process to reduce materials and processing failure Includes detailed case studies that illustrate best practices across a wide range of applications and

industry sectors Presents a new chapter on the Industry 4.0 concept Suggests software solutions to assist with design decision making and management along with other forms of automation

Introduction to Plastics Engineering

Anshuman Shrivastava, 2018-05-15 Introduction to Plastics Engineering provides a single reference covering the basics of polymer and plastics materials and their properties design processing and applications in a practical way The book discusses materials engineering through properties formulation combining part design and processing to produce final products This book will be a beneficial guide to materials engineers developing new formulations processing engineers producing those formulations and design and product engineers seeking to understand the materials and methods for developing new applications The book incorporates material properties engineering processing design applications and sustainable and bio based solutions Ideal for those just entering the industry or transitioning between sectors this is a quick relevant and informative reference guide to plastics engineering and processing for engineers and plastics practitioners Provides a single unified reference covering plastics materials properties design processing and applications Offers end to end coverage of the industry from formulation to part design processing and the final product Serves as an ideal introductory book for new plastics engineers and students of plastics engineering Provides a convenient reference for more experienced practitioners

Chemical Resistance of Thermosets Erwin Baur, Katja Ruhrberg, William Woishnis, 2018-04-27 Chemical Resistance of Commodity Thermoplastics provides a comprehensive cross referenced compilation of chemical resistance data that explains the effect of thousands of reagents the environment and other exposure media on the properties and characteristics of thermosets plastics which are used in a range of applications Specifically the resistance data in this book covers the following materials allyl epoxy unsaturated polyester resin unsaturated polyurethane resin vinyl ester resin furan resin polyaminobismaleimide acrylics polycyanurates and filled reinforced thermosets A huge range of exposure media are included from aircraft fuel to alcohol corn syrup hydrochloric acid and salt to silver acetate This book is a must have reference for engineers and scientists designing and working with thermosets in environments where they come into contact with corrosive or reactive substances from automotive and aerospace to coatings adhesives electrical insulation fittings and other applications Presents comprehensive comparable and trustworthy chemical resistance data for thousands of exposure media on the properties of thermosets Includes coverage of ionomers polyethylene polypropylene polystyrene PVC and other polyolefins and polyesters Provides a must have reference for engineers selecting materials for a range of application areas using thermosets including aerospace automotive chemical process industries coatings and adhesives

Hydraulic Rubber

Dam Sabu Thomas, Ajay Vasudeo Rane, Abitha VK, Krishnan Kanny, Aastha Dutta, 2018-11-30 Hydraulic Rubber Dam An Effective Water Management Technology is the go to source for information on the materials manufacture mechanics and functional benefit of rubber dams in water management Readers will find a detailed background on water conservation and coverage how inflatable rubber dam technology contributes to the picture and information on the proper manufacture and

use of rubber dams to increase water storage for release and delivery during drought In addition the book presents tactics on the even distribution of water across populations how to increase water use efficiency conservation and how to prevent flooding In particular this book details specialist manufacturing techniques including the development of rubber compounds and fabric the bonding and anchoring systems which hold the rubber dam to the underlying concrete structure and inflation and deflation mechanisms for rubber dams The book provides a holistic lifecycle assessment of rubber dams to give additional insight to readers looking to deploy rubber dam technology Demonstrates the proper use of rubber dams in water management especially in flood prevention and water conservation during drought Includes guidance on the materials engineering of rubber and technical fabrics involved in the construction of dams bonding and anchoring systems and inflation and deflation mechanisms Presents thorough coverage of modelling and stress analysis along with lifecycle assessment of inflatable rubber dams

Recycling of Polyurethane Foams Sabu Thomas,Ajay Vasudeo Rane,Krishnan Kanny,Abitha VK,Martin George Thomas,2018-06-06 Recycling of Polyurethane Foams introduces the main degradation depolymerization processes and pathways of polyurethane foam materials focusing on industrial case studies and academic reviews from recent research and development projects The book can aid practitioners in understanding the basis of polymer degradation and its relationship with industrial processes which can be of substantial value to industrial complexes the world over The main pathways of polymer recycling via different routes and industrial schemes are detailed covering all current techniques including regrinding rebinding adhesive pressing and compression moulding of recovered PU materials that are then compared with depolymerization approaches The book examines life cycle assessment and cost analysis associated with polyurethane foams waste management showing the potential of various techniques This book will help academics and researchers identify and improve on current depolymerization processes and it will help industry sustainability professionals choose the appropriate approach for their own waste management systems thus minimizing the costs and environmental impact of their PU based end products Offers a comprehensive review of all polyurethane foam recycling processes including both chemical and mechanical approaches Assesses the potential of each recycling process Helps industry based practitioners decide which approach to take to minimize the cost and environmental impact of their end product Enables academics and researchers to identify and improve upon current processes of degradation and depolymerization

Recycling of Polyethylene Terephthalate Bottles Sabu Thomas,Ajay Vasudeo Rane,Krishnan Kanny,Abitha VK,Martin George Thomas,2018-10-29 Recycling of Polyethylene Terephthalate Bottles provides an overview of PET chemistry highlighting the main degradation depolymerization processes and pathways of PET along with the applications of recycled monomers derived from PET waste The latest methodologies of recycling and feedstock recovery are covered providing critical foundational information In addition the book discusses a range of established methods of polymer recycling with an emphasis on real world industrial case studies and the latest academic research Users will find in depth lifecycle and cost

analysis of each waste management method comparing the suitability and feasibility of each to support the decision making process Polyethylene Terephthalate PET is the most recycled plastic in the world but still represents a significant amount of landfill waste This book presents an update on new regulations providing recommendations for new opportunities in this area including new processing methods and applications for recycled PET Features a comprehensive introduction to the waste management of PET bottles from regulatory concerns to the range of different methods of materials recovery Enables practitioners to choose the most efficient and effective waste management process Includes detailed lifecycle and cost analysis information Compares traditional thermal recycling methods with more recently developed monomer recovery and chemical recycling methods Plastics to Energy Sultan Al-Salem, 2018-11-05 Plastics to Energy Fuel Chemicals and Sustainability Implications covers important trends in the science and technology of polymer recovery such as the thermo chemical treatment of plastics the impact of environmental degradation on mechanical recycling incineration and thermal unit design and new options in biodegradable plastics The book also introduces product development opportunities from waste materials and discusses the main processes and pathways of the conversion of polymeric materials to energy fuel and chemicals A particular focus is placed on industrial case studies and academic reviews providing a practical emphasis that enables plastics practitioners involved in end of life aspects to employ these processes Final sections examine lifecycle and cost analysis of different plastic waste management processes exploring the potential of various techniques in modelling optimization and simulation of waste management options Introduces new pathways for the end of life treatment of plastics and polymers including conversion to energy fuel and other chemicals Compares different options to assist materials scientists engineers and waste management practitioners to choose the most effective and sustainable option Covers the latest trends in the science and technology of polymer energy recovery

Reviewing **Manufacturing And Novel Applications Of Multilayer Polymer Films**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Manufacturing And Novel Applications Of Multilayer Polymer Films**," an enthralling opus penned by a highly acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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Manufacturing And Novel Applications Of Multilayer Polymer Films Introduction

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