

Degradable Polymers Recycling And Plastics Waste Management Plastics Engineering

This book reviews the and industrial applications of properties polymers and discusses their environmental benefits compared with traditional materials. It also addresses the issues of polymer durability, recycling processes to aid waste minimization, and biodegradable polymers. This book introduces the non-specialist to the benefits and limitations of polymeric materials from an environmental viewpoint.

The degradation of plastics is most important for the removal and recycling of plastic wastes. The book presents a comprehensive overview of the field. Topics covered include plastic degradation methods, mechanistic actions, biodegradation, involvement of enzymes, photocatalytic degradation and the use of cyanobacteria. Also covered are the market of degradable plastics and the environmental implications. Keywords: Degradable Plastics, Bioplastics, Biodegradable Plastics, Enzymes, Cyanobacteria, Photocatalytic Degradation, Wastewater Treatment, Degradable Plastic Market, Polyethylene, Polypropylene, Polystyrene, Polyvinyl Chloride, Polyurethane, and Polyethylene Terephthalate.

Biodegradable polymers have experienced strong growth over the last three years and are set to make further inroads into markets traditionally dominated by conventional

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thermoplastics in future. Four main classes of biodegradable polymers are analysed in this report, polylactic acid (PLA), starch-based polymers, synthetic biodegradable polymers, such as aromatic aliphatic co-polyesters, and polyhydroxyalkanoates (PHA). The report analyses their key performance properties, applications development, market drivers and future prospects. Each product section also contains an estimate of market size by world region and end use market, plus forecasts to 2010. There is also an analysis of key suppliers and their products.

Plastics possess properties that have revolutionized the manufacture of products in the 20th century and beyond. It remains critical to understand their behavior throughout their life cycle, from manufacture to use and eventually to reclamation and disposal. This volume highlights the most prominent tools in physical and chemical analysis techniques and applications. A practical reference for performing measurements, solving problems, and investigating behavioral phenomena, the editors advocate a phenomenological approach, relying on case studies and illustrations to represent possible outcomes of each technique and presenting the basic governing equations where necessary.

Based on the International Workshop on Controlled Life-Cycle of Polymeric Materials held in Stockholm, this work examines degradable polymers and the recycling of plastic materials. It highlights recent results on recycling and waste management, including topics such as renewable resources, degradation, processing and products, and

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environmental is

In the past 25 years, plastic products have gained universal use not only in food, clothing and shelter, but also in the transportation, construction, medical and leisure industries. Whereas previously synthetic plastics were developed as durable substitute products, increasing concern for the global environment and solid waste management has resulted in an urgent demand for biodegradable plastics. The main topics of the Third International Scientific Workshop were as follows: 1. Biodegradation of polymers and plastics 2. Environmental degradation of plastics 3. Synthesis and properties of new biodegradable plastic materials 4. Biodegradation and morphologies of polymer blends 5. Development of biodegradation test methods 6. Governmental policy, regulation and standards.

Plastics offer a variety of environmental benefits. However, their production, applications, and disposal present many environmental concerns. Plastics and the Environment provides state-of-the-art technical and research information on the complex relationship between the plastic and polymer industry and the environment, focusing on the sustainability, environmental impact, and cost—benefit tradeoffs associated with different technologies. Bringing together the field's leading researchers, Anthony Andrady's innovative collection not only covers how plastics affect the environment, but also how environmental factors affect plastics. The relative benefits of recycling, resource recovery, and energy recovery are also discussed in

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detail. The first of the book's four sections represents a basic introduction to the key subject matter of plastics and the environment; the second explores several pertinent applications of plastics with environmental implications—packaging, paints and coatings, textiles, and agricultural film use. The third section discusses the behavior of plastics in some of the environments in which they are typically used, such as the outdoors, in biotic environments, or in fires. The final section consists of chapters on recycling and thermal treatment of plastics waste. Chapters include: Commodity Polymers Plastics in Transportation Biodegradation of Common Polymers Thermal Treatment of Polymer Waste Incineration of Plastics The contributors also focus on the effectiveness of recent technologies in mitigating environmental impacts, particularly those for managing plastics in the solid waste stream. Plastic and design engineers, polymer chemists, material scientists, and ecologists will find *Plastics and the Environment* to be a vital resource to this critical industry.

Synthetic and semi-synthetic polymeric materials were originally developed for their durability and resistance to all forms of degradation including biodegradation. Such materials are currently widely accepted because of their ease of processability and amenability to provide a large variety of cost effective items that help to enhance the comfort and quality of life in the modern industrial society. However, this widespread utilization of plastics has contributed to a serious plastic waste burden, and the expectation for the 21st century is for an increased demand for polymeric material. This

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volume focuses on a more rational utilization of resources in the fabrication, consumption and disposal of plastic items, specifically: -Environmentally Degradable Polymeric Materials (EDPs); -Water-soluble/Swellable Biodegradable Polymers; -EDPs from Renewable Resources; -Biopolymers; -Bioresorbable Materials for Biomedical Applications; -Biorelated Polymers; -Standards and Regulations on EDPs. Plastics, Polymers, Degradation, Biodegradability, Decomposition reactions, Waste handling, Recycling, Vocabulary
Recycling of Plastic Materials

Based on the International Workshop on Controlled Life-Cycle of Polymeric Materials held in Stockholm, this work examines degradable polymers and the recycling of plastic materials. It highlights recent results on recycling and waste management, including topics such as renewable resources, degradation, processing and products, and environmental issues.

This timely reference on the topic is the only book you need for a complete overview of recyclable polymers. Following an introduction to various polymer structures and their resulting properties, the main part of the book deals with different methods of recycling. It discusses in detail the recycling of such common polymers as polyethylene, polypropylene and PET, as well as rubbers, fibers, engineering polymers, polymer blends and composites. The whole is

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rounded off with a look at future technologies and the toxicological impact of recycled polymers. An indispensable reference source for those working in the field, whether in academia or industry, and whether newcomers or advanced readers.

Bio-based polymers can make excellent candidates for sustainable materials. In this regard, the most recent advances in the biodegradable and bio-based polymers and plastics field were discussed at the 8th World Conference on Biodegradable Polymers and Plastics.

Compostable Polymer Materials, Second Edition, deals with the environmentally important family of polymers designed to be disposed of in industrial and municipal compost facilities after their useful life. These compostable plastics undergo degradation and leave no visible, distinguishable, or toxic residue. Environmental concerns and legislative measures taken in different regions of the world make composting an increasingly attractive route for the disposal of redundant polymers. This book covers the entire spectrum of preparation, degradation, and environmental issues related to compostable polymers. It emphasizes recent studies concerning compostability and ecotoxicological assessment of polymer materials. It describes the thermal behavior, including flammability properties, of compostable polymers. It also explores possible routes

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of compostable polymers waste disposal through an ecological lens. Finally, the book examines the economic factors at work, including price evolution over the past decade, the current market, and future perspectives. Compostable Polymer Materials is an essential resource for graduate students and scientists working in chemistry, materials science, ecology, and environmental science. Provides a comprehensive study of the composting process Details methods of compostable polymers preparation, including properties, processing and applications Presents the state-of-the-art knowledge on ecotoxicity testing and biodegradation under real composting conditions of compostable polymers, as well as biodegradation in various environments, such as marine environments and anaerobic conditions Discusses the evolution of waste management in Europe and the United States, as well as the status of MSW disposal and treatment methods in countries such as China and Brazil Overviews biodegradation studies under real composting conditions of products made of compostable polymers, e.g. bags, bottles, cutlery Analyzes evolution of market development, including price of compostable polymers during the last decade

This new Handbook provides engineers and scientists with the information and practical guidance needed to successfully design and manufacture products using biopolymers and biodegradable plastics. Biopolymers and biodegradable

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plastics are a hot issue across the plastics industry, and for many of the industry sectors that use plastic: from packaging to medical devices and from the construction industry to the automotive sector. This book brings together in one place a number of key biopolymer and biodegradable plastics topics-in chapters previously published as well as updated and new chapters-for a broad audience of engineers of and scientists, especially those designing with biopolymers and biodegradable plastics or evaluating the options for switching from traditional plastics to biopolymers. Topics covered include preparation, fabrication, applications and recycling (including biodegradability and compostability). Applications in key areas such as films, coatings, controlled release, and tissue engineering are discussed.

Providing guidelines for implementing sustainable practices for traditional petroleum based plastics, biobased plastics, and recycled plastics, Sustainable Plastics and the Environment explains what sustainable plastics are, why sustainable plastics are needed, which sustainable plastics to use, and how manufacturing companies can integrate them into their manufacturing operations. A vital resource for practitioners, scientists, researchers, and students, the text includes impacts of plastics including Life Cycle Assessments (LCA) and sustainability strategies related to biobased plastics and petroleum based plastics

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as well as end-of-life options for petroleum and biobased plastics.

Plastics have become one of the most prolific materials on the planet: in 2015 we produced about 380 million tonnes of plastics globally, up from 2 million tonnes in the 1950s. Yet today only 15% of this plastic waste is collected and recycled into secondary plastics globally each year. This ...

Plastic films are high-performance materials which play an essential part in modern life. The plastics films industry uses state-of-the-art manufacturing processes and is continuously seeking out new technologies to improve its performance. The understanding of the nature of plastic films, their production techniques, applications and their characterisation is essential for producing new types of plastic films. This handbook has been written to discuss the production and main uses of plastic films. Plastic films are high-performance materials which play an essential part in modern life. Plastic films are mostly used in packaging applications but as will be seen from this book they are also used in the agricultural, medical and engineering fields. The plastics films industry uses state-of-the-art manufacturing processes and is continuously seeking out new technologies to improve its performance. The understanding of the nature of plastic films, their production techniques, applications and their characterisation is essential for producing new types of plastic films. This handbook has been

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written to discuss the production and main uses of plastic films.

This book is a complete guide to polymers, which degrade naturally once they are finished with. This is an especially important topic at the moment as landfill space is getting less and other methods of recycling can be very costly. This book discusses the different types of biodegradable polymers, both naturally occurring and synthetic, and how they are used and the mechanisms for degradation.

Biodegradable plastics made with plant based materials have been available for many years. The term biodegradable means that a substance is able to be broken down into simpler substances by the activities of living organisms, and therefore is unlikely to persist in the environment. There are many different standards used to measure biodegradability, with each country having its own. The requirements range from 90 per cent to 60 per cent decomposition of the product within 60 to 180 days of being placed in a standard composting environment. They may be composed of either bio plastics, which are plastics whose components are derived from renewable raw materials, or petroleum based plastics which contain additives. Biodegradability of plastics is dependent on the chemical structure of the material and on constitution of the final product, not just on the raw materials used for its production. Polyesters play a

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predominant role as biodegradable plastics due to their potentially hydrolysable ester bonds. Bio based polymers are divided into three categories based on their origin and production; polymer directly extracted from biomass, polymers produced by classical chemical synthesis using renewable biomass monomer and polymers produced by microorganisms or genetically modified bacteria. In response to public concern about the effects of plastics on the environment and in particular the damaging effects of sea litter on animals and birds, legislation is being enacted or is pending in many countries to ban non degradable packing, finishing nets etc. This book basically deals with biodegradable plastics developments and environmental impacts, hydro biodegradable and photo biodegradable, starch synthetic aliphatic polyester blends, difference between standards for biodegradation, polybutylene succinate (pbs) and polybutylene, recent developments in the biopolymer industry, recent advances in synthesis of biopolymers by traditional methodologies, polymers, environmentally degradable synthetic biodegradable polymers as medical devices, polymers produced from classical chemical synthesis from bio based monomers, potential bio based packaging materials, conventional packaging materials, environmental impact of bio based materials: biodegradability and compostability, etc. Environmentally acceptable degradable polymers have been defined as polymers that degrade in

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the environment by several mechanisms and culminate in complete biodegradation so that no residue remains in the environment. The present book gives thorough information to biodegradable plastic and polymers. This is an excellent book for scientists engineers, students and industrial researchers in the field of bio based materials.

The vast majority of plastic products are made from petroleum-based synthetic polymers that do not degrade in a landfill or in a compost-like environment. Therefore, the disposal of these products poses a serious environmental problem. An environmentally-conscious alternative is to design/synthesize polymers that are biodegradable. Biodegradable polymers for industrial applications introduces the subject by outlining the classification and development of biodegradable polymers. Materials available for the production of biodegradable polymers are explored. Polymers derived from sugars, natural fibres, renewable forest resources, poly(lactic acid) and protein-nanoparticle composites are looked at in detail in this section. The properties and mechanisms of degradation are looked at, prefacing the subject with a chapter on current standards. The final part explores opportunities for industrial applications, with chapters on packing, agriculture and biodegradable polycaprolactone foams in supercritical carbon dioxide. Biodegradable polymers for industrial applications

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explores the fundamental concepts concerning the development of biodegradable polymers, degradable polymers from sustainable sources, degradation and properties and industrial applications. It is an authoritative book that is invaluable for academics, researchers and policy makers in the industry. Reviews the importance and industrial use of biodegradable polymers and degradable polymers from sustainable sources An invaluable resource for both academics and industry Edited by a leading authority in the field with contributions from a worldwide team of experts

Maintaining a balance between depth and breadth, the Sixth Edition of Principles of Polymer Systems continues to present an integrated approach to polymer science and engineering. A classic text in the field, the new edition offers a comprehensive exploration of polymers at a level geared toward upper-level undergraduates and beginning graduate students. Revisions to the sixth edition include: A more detailed discussion of crystallization kinetics, strain-induced crystallization, block copolymers, liquid crystal polymers, and gels New, powerful radical polymerization methods Additional polymerization process flow sheets and discussion of the polymerization of polystyrene and poly(vinyl chloride) New discussions on the elongational viscosity of polymers and coarse-grained bead-spring molecular and tube models Updated information on models and

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experimental results of rubber elasticity Expanded sections on fracture of glassy and semicrystalline polymers New sections on fracture of elastomers, diffusion in polymers, and membrane formation New coverage of polymers from renewable resources New section on X-ray methods and dielectric relaxation All chapters have been updated and out-of-date material removed. The text contains more theoretical background for some of the fundamental concepts pertaining to polymer structure and behavior, while also providing an up-to-date discussion of the latest developments in polymerization systems. Example problems in the text help students through step-by-step solutions and nearly 300 end-of-chapter problems, many new to this edition, reinforce the concepts presented.

Appendix includes formulas and procedures for making plastics.

The emphasis in degradable polymers has changed since the first edition of this book. Biomedical and agricultural applications remain important topics of scientific and commercial interest in the second edition. However, an increased emphasis on composting as a means of recovering value from wastes has led to a new impetus to understand how plastics degrade in the environment and the implication of this for international standards. Polymers based on renewable resources are also a major topic in this edition but the debate continues about their long-term sustainability and ecological advantages over degradable man-

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made polymers. Degradable Polymers will be of interest not only to academic and industrial scientists working on packaging, agricultural and medical applications of plastics but also to students of environmental science and legislators concerned with the effects of man-made materials in the environment. *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

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management practitioners to choose the most effective and sustainable option
Covers the latest trends in the science and technology of polymer energy recovery

This book, on recycling of PVC and mixed plastic wastes, has been compiled from contributions from an array of scientists from several countries who are playing a leading role in plastic recycling. They offer practical solutions to many difficult problems in this field. Anyone involved in production of materials from virgin polymers who is concerned with their recyclability should read this book. The ideas and data presented will help the process of planning future recycling efforts and help to bring the recycling process from a costly nuisance to a profitable industry.

Automotive Plastics and Composites: Materials and Processing is an essential guide to the use of plastic and polymer composites in automotive applications, whether in the exterior, interior, under-the-hood, or powertrain, with a focus on materials, properties, and processing. The book begins by introducing plastics and polymers for the automotive industry, discussing polymer materials and structures, mechanical, chemical, and physical properties, rheology, and flow analysis. In the second part of the book, each chapter is dedicated to a category of material, and considers the manufacture, processing, properties, shrinkage,

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and possible applications, in each case. Two chapters on polymer processing provide detailed information on both closed-mold and open-mold processing. The final chapters explain other key aspects, such as recycling and sustainability, design principles, tooling, and future trends. This book is an ideal reference for plastics engineers, product designers, technicians, scientists, and R&D professionals who are looking to develop materials, components, or products for automotive applications. The book also intends to guide researchers, scientists, and advanced students in plastics engineering, polymer processing, and materials science and engineering. Analyzes mechanical, chemical, physical, and thermal properties, enabling the reader to select the appropriate material for specific applications Explains polymer processing, with thorough coverage of operations across both closed-mold and open-mold processing Provides systematic coverage of materials, including commodity and engineering thermoplastics, bio-based plastics, thermosets, composites, elastomeric polymers, and 3D-printed plastics

In this report the factors which influence biodegradation are first explained. Methods of testing and evaluating biodegradation are then described and compared. The principles, relative costs and practical applications of specific tests are outlined together with the position with respect to recognised standards.

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The range of biodegradable polymers and polymer blends is then described, including natural and synthetic products. An additional indexed section containing several hundred abstracts from the Rapra Polymer Library database provides useful references for further reading.

Degradable Polymers, Recycling, and Plastics Waste Management CRC Press
This book discusses the development of bio-based plastics and associated nanocomposites in order to achieve targeted structural morphologies, and physical and chemical properties for use in food-packaging applications. In line with bio-based and/or biodegradable plastic matrices, the current status of the development of multifaceted bionanofillers is also explored in detail. This book begins by addressing the past, present and future prospects of bio-based and/or biodegradable polymers in specific food-packaging applications, and the importance and advantages of such packaging over fossil polymer-based packaging materials. Furthermore, this book also examines the current commercial overview of bio-based and/or biodegradable polymers and nanocomposites, and the structure-property relationship required for various advanced applications. Individual chapters detail bio-based polymers, bio-derived and microbial-derived plastics, which include exclusive investigations on the most promising polymers, such as polylactic acid (PLA) and polyhydroxyalkanoates

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(PHA), and their bionanocomposites, for food-packaging applications. Detailed discussions highlight the various properties of polymers for food-packaging applications including bio-based and/or biodegradable polymers and nanocomposites. The processing of blends using bio-based and/or biodegradable polymers and non-degradable polymers for food-packaging applications are also featured. In addition, extensive discussions include different edible biopolymer-based coatings on food items which can act as effective carriers for improving the shelf life of food. Moreover, various end-of-life solutions of plastics such as recycling, reuse, composting and so on, for the safe disposal of plastic waste are reviewed. Finally, this book discusses migration studies, and safety legislation and regulations of such packages in contact with food, which are currently being performed by various organisations across the world. Throughout the book, detailed case studies are included on sustainable polymers, and associated nanocomposites, along with different perspectives on their industrial applications, and critical challenges and opportunities for developing biopolymer nanocomposites for food-packaging applications. The first part of the book establishes the importance of biobased and biodegradable plastics in response to the mainly petroleum based plastics, while the technical and industrial aspects of biobased and biodegradable plastics, such

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as resources, manufacturing, recycling and regulations, are comprehensively treated in the second part. The next part deals with the challenges of an increase in biobased and biodegradable plastics, such as the impact on plastic recycling efforts and the necessary regulatory framework, and addresses the impact on markets and users. The book closes with selected examples of cutting edge research from around the world.

The scourge of plastic has poisoned our environment and damaged our health. In this timely book, Albert Bates takes a critical look at the magnitude of this ubiquitous problem, and explains that what is needed is mandatory economic and industrial changes so that recycled, bio-sourced, and biodegradable plastic become more cost-effective than plastic made from fossil fuels. He also explores current worldwide efforts for stronger regulations and better waste management, along with exciting new biological and man-made technologies for improved plastics disposal and viable alternatives . Packed with anecdotes and tips for living with less plastic, it is clearly defined that if we take real action now there is the potential of hope.

The rapid development of polymer technology in recent years has produced an increasing range of new polymers and additives, and seen much innovation in processing technologies. The need for understanding the relationships between

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polymeric structure, processing conditions and material properties is therefore greater than ever before. The EUROMAT 2001 conference held in June 2001 in Rimini, Italy was an ideal international forum for dealing with this complex subject. Selected lectures are presented in this volume of Macromolecular Symposia, which should be of interest to scientists of polymer chemistry and of polymer blending, processing and recycling, in academia and industry, alike.

This book contains most of the contributions from the 5th International Scientific Workshop on Biodegradable Plastics and polymers. The contributions are covering the following subjects: - synthesis of novel degradation polymers - enzymatic polymerization - kinetic and mechanistic aspects of (bio) degradation - industrial development in degradable polymers

"Integrates the latest findings on metallized plastics and their far-reaching applications by more than 80 recognized experts from North America, Europe, the Middle East, and Asia. Addresses both basic and applied aspects of the subject."

Polymers, main components of plastics and rubbers, are being discarded in increasing quantities. But this waste can also be considered as 'plastic gold'. Public concern, coupled with the inherent value of the material, means that recycling is imperative. The present book presents a survey of current knowledge in the form of case studies, including current legal and educational issues. Topics covered also include regulation and practice in NATO countries, the economics of recycling, the reprocessing of single

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polymers and mixtures, and future prospects and strategies. Audience: Vital reading for all polymer scientists, technicians and engineers.

Understand, design, and manufacture plastics This resource provides you with the state-of-the-art information for the design, manufacture and application of plastics as well as its cutting-edge usage in nanotechnology. Includes the latest industry specifications and standards Covers the latest recycling methods

Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions begins with an introduction to the different types of plastic materials, their uses, and the concepts of reduce, reuse and recycle before examining plastic types, chemistry and degradation patterns that are organized by non-degradable plastic, degradable and biodegradable plastics, biopolymers and bioplastics. Other sections cover current challenges relating to plastic waste, explain the sources of waste and their routes into the environment, and provide systematic coverage of plastic waste treatment methods, including mechanical processing, monomerization, blast furnace feedstocks, gasification, thermal recycling, and conversion to fuel. This is an essential guide for anyone involved in plastic waste or recycling, including researchers and advanced students across plastics engineering, polymer science, polymer chemistry, environmental science, and sustainable materials.

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