Catalytic Conversion Of Plastic Waste To Fuel

A Practical Guide to Plastics Sustainability: Concept, Solutions, and Implementation is a groundbreaking reference work offering a broad, detailed and highly practical vision of the complex concept of sustainability in plastics. The book's aim is to present a range of potential pathways towards more sustainable plastics parts and products, enabling the reader to further integrate the idea of sustainability into their design process. It begins by introducing the context and concept of sustainability, discussing perceptions, drivers of change, key factors, and environmental issues, before presenting a detailed outline of the current situation with types of plastics, processing, and opportunities for improved sustainability. Subsequent chapters focus on the different possibilities for improved sustainability, offering a step-by-step technical approach to areas including design, properties, renewable plastics, and recycling and re-use. Each of these pillars are supported by data, examples, analysis and best practice guidance. Finally, the latest developments and future possibilities are considered. Approaches the idea of sustainability from numerous angles, offering practical solutions to improve sustainability in the development of plastic components and products Explains how sustainability can be applied across plastics design, materials selection, processing, and end of life, all set alongside socioeconomic factors Considers key areas of innovation, such as eco-design, novel opportunities for recycling or re-use, bio-based polymers and new technologies

This handbook is an edited version of the final report of the European Commission and IEA Bioenergy sponsored Pyrolysis Network that officially finished in 2004. It provides a companion volume to the first (ISBN 978-1-872691-07-7) and second (ISBN 978-1-872691-47-3) handbooks published in 1999 and 2002 respectively also available from CPL Press (www.cplpress.com). It is again intended that this will provide a useful guide both to newcomers to the subject area as well as those already involved in research, development and implementation. A significant feature of this third volume is the greater attention paid to wider issues concerning pyrolysis including environment, health and safety, norms and standards and marketability.

This book describes how man-made litter, primarily plastic, has spread into the remotest parts of the oceans and covers all aspects of this pollution problem from the impacts on wildlife and human health to socio-economic and political issues. Marine litter is a prime threat to marine wildlife, habitats and food webs worldwide. The book illustrates how advanced technologies from deep-sea research, microbiology and mathematic modelling as well as classic beach litter counts by volunteers contributed to the broad awareness of marine litter as a problem of global significance. The authors summarise more than five decades of marine litter research, which receives growing attention after the recent discovery of great oceanic garbage patches and the ubiquity of microscopic plastic particles in marine organisms and habitats. In 16 chapters, authors from all over the world have created a universal view on the diverse field of marine litter pollution, the biological impacts, dedicated research activities, and the various national and international legislative efforts to combat this environmental problem. They recommend future research directions necessary for a comprehensive understanding of this environmental issue and the development of efficient management strategies. This book addresses scientists, and it provides a solid knowledge base for policy makers, NGOs, and the broader public.

Pyrolysis is an irreversible thermochemical treatment process of materials at elevated temperatures in an inert atmosphere. It is basically a carbonisation process where an organic material is decomposed to produce a solid residue with high (or higher) carbon content and some volatile products. The decomposition reactions are accompanied in general with polymerisation and isomerisation reactions. The end products of pyrolysis can be controlled by optimizing pyrolysis parameters such as temperature and residence time. Pyrolysis is used heavily in the chemical industry to produce many forms of carbon and other chemicals from petroleum, coal, wood, oil shale, biomass or organic waste materials, and it is the basis of several methods for producing fuel from biomass. Pyrolysis also is the process of conversion of buried organic matter into fossil fuels.

Academic Paper from the year 2020 in the subject Chemistry - Materials Chemistry, , language: English, abstract: Biodiesel or in general biofuels can be produced in a complex process of transesterification or in hydrotreatment of oil. To do this a catalyst is required. The conversion process of used oil is the aim of this paper. This paper identifies clay or zeolite as catalyst material which is required to convert used cooking oil into useful chemicals. The information presented forward offers a deep insight of products that are obtainable from the conversion of waste cooking oil.

In chemical processes, the progressive deactivation of solid catalysts is a major economic concern and mastering their stability has become as essential as controlling their activity and selectivity. For these reasons, there is a strong motivation to understand the mechanisms leading to any loss in activity and/or selectivity and to find out the efficient preventive measures and regenerative solutions that open the way towards cheaper and cleaner processes. This book covers the fundamental and applied aspects of solid catalyst deactivation in a comprehensive way and encompasses the state of the art in the field of reactions catalyzed by zeolites. This particular choice is justified by the widespread use of molecular sieves in refining, petrochemicals and organic chemicals synthesis processes, by the large variety in the nature of their active sites (acid, base, acid-base, redox, bifunctional) and especially by their peculiar features, in terms of crystallinity, structural order and textural properties, which make them ideal models for heterogeneous catalysis. The aim of this book is to be a critical review in the field of zeolite deactivation and regeneration by collecting contributions from experts in the field which describe the factors, explain the techniques to study the causes and suggest methods to prevent (or limit) catalyst deactivation. At the same time, a selection of commercial processes and exemplar cases provides the reader with theoretical insights and practical hints on the deactivation mechanisms and draws attention to the key role

played by the loss of activity on process design and industrial practice./a

"A comprehensive guide to solid-state chemistry which is ideal for all undergraduate levels. It covers well the fundamentals of the area, from basic structures to methods of analysis, but also introduces modern topics such as sustainability." Dr. Jennifer Readman, University of Central Lancashire, UK "The latest edition of Solid State Chemistry combines clear explanations with a broad range of topics to provide students with a firm grounding in the major theoretical and practical aspects of the chemistry of solids." Professor Robert Palgrave, University College London, UK Building a foundation with a thorough description of crystalline structures, this fifth edition of Solid State Chemistry: An Introduction presents a wide range of the synthetic and physical techniques used to prepare and characterise solids. Going beyond this, this largely nonmathematical introduction to solid-state chemistry includes the bonding and electronic, magnetic, electrical, and optical properties of solids. Solids of particular interest—porous solids, superconductors, and nanostructures—are included. Practical examples of applications and modern developments are given. It offers students the opportunity to apply their knowledge in real-life situations and will serve them well throughout their degree course. New in the Fifth Edition A new chapter on sustainability in solid-state chemistry written by an expert in this field Cryo-electron microscopy X-ray photoelectron spectroscopy (ESCA) Covalent organic frameworks Graphene oxide and bilayer graphene Elaine A. Moore studied chemistry as an undergraduate at Oxford University and then stayed on to complete a DPhil in theoretical chemistry with Peter Atkins. After a two-year postdoctoral position at the University of Southampton, she joined the Open University in 1975, becoming a lecturer in chemistry in 1977, senior lecturer in 1998, and reader in 2004. She retired in 2017 and currently has an honorary position at the Open University. She has produced OU teaching texts in chemistry for courses at levels 1, 2, and 3 and written texts in astronomy at level 2 and physics at level 3. She was team leader for the production and presentation of an Open University level 2 chemistry module delivered entirely online. She is a Fellow of the Royal Society of Chemistry and a Senior Fellow of the Higher Education Academy. She was co-chair for the successful Departmental submission of an Athena Swan bronze award. Lesley E. Smart studied chemistry at Southampton University, United Kingdom. After completing a PhD in Raman spectroscopy, she moved to a lectureship at the (then) Royal University of Malta. After returning to the United Kingdom, she took an SRC Fellowship to Bristol University to work on X-ray crystallography. From 1977 to 2009, she worked at the Open University chemistry department as a lecturer, senior lecturer, and Molecular Science Programme director, and she held an honorary senior lectureship there until her death in 2016. At the Open University, she was involved in the production of undergraduate courses in inorganic and physical chemistry and health sciences. She served on the Council of the Royal Society of Chemistry and as the chair of their Benevolent Fund.

Pyrolysis is a recycling technique converting plastic waste into fuels, monomers, or other valuable materials by thermal and catalytic cracking processes. It allows the treatment of mixed, unwashed plastic wastes. For many years research has been carried out on thermally converting waste plastics into useful hydrocarbons liquids such as crude oil and diesel fuel. Recently the technology has matured to the point where commercial plants are now available. Pyrolysis recycling of mixed waste plastics into generator and transportation fuels is seen as the answer for recovering value from unwashed, mixed plastics and achieving their desired diversion from landfill. This book provides an overview of the science and technology of pyrolysis of waste plastics. It describes the types of plastics that are suitable for pyrolysis recycling, the mechanism of pyrolytic degradation of various plastics, characterization of the pyrolysis products and details of commercially mature pyrolysis technologies. This book also covers co-pyrolysis technology, including: waste plastic/waste oil, waste plastics/coal, and waste plastics/rubber.

Catalysts are required for a variety of applications. Industrialists and academics are increasingly challenged to find cost effective and environmentally benign catalysts to use. This volume looks at modern approaches to catalysis and critically reviews the extensive literature on areas such as catalysts derived from waste materials, determining the pore structure of activated carbon by nitrogen gas adsorption and a new tool to explore catalytic reaction mechanisms - the catalytic shock tube. With an emphasis on interdisciplinary content, this book is aimed at catalytic science and engineering research communities.

Todays chemical industry processes worldwide largely depend on catalytic reactions and the desirable future evolution of this industry toward more selective products, more environmentally friendly products, more energy-efficient processes, a smaller use of hazardous reagents, and a better use of raw materials also largely involves the development of better catalysts and, specifically, purposely designed catalytic materials. The careful study and development of the new-generation catalysts involve relatively large groups of specialists in universities, research centers, and industries, joining forces from different scientific and technical disciplines. This book has put together recent, state-of-the-art topics on current trends in catalytic materials and consists of 16 chapters.

This volume discusses the structure and growth of the plastics industry, comprehensively displaying the complete cycle of plastics from raw materials to waste and solutions related to this waste - presenting practical cost scenarios for the collection and disposal of waste.;Examining the issue of plastics waste in a broad social and environmental context, Plastics Waste Management: considers the regulations imposed on waste disposal and aspects of pollution control acts; provides a technical overview of polymers, classifications, and properties as well as the plastics industry, polymer production, and consumption; addresses extrusion basics and polymers' compatibility in a mixture of plastic waste; describes the recycling of mixed plastics waste; and explores design considerations and product life cycles with respect to environmentally friendly products in packaging applications.;Furnishing more than 400 bibliographic citations, Plastics Waste Management is a reference for pollution control, plastics, environmental, polymer and chemical engineers; recycling facility operators; plastics designers; and upper-level undergraduate and graduate students in these disciplines.

Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Volume 1: Biological Processes presents advanced and combined techniques that can be used to convert waste to energy, including combustion, gasification, paralysis, anaerobic digestion and fermentation. The book focuses on solid waste conversion to fuel and energy and presents the latest advances in the design, manufacture, and application of conversion technologies. Contributors from the fields of physics, chemistry, metallurgy, engineering and manufacturing present a truly trans-disciplinary picture of the field. Chapters cover important aspects surrounding the conversion of solid waste into fuel and chemicals, describing how valuable energy can be recouped from various waste materials. As huge volumes of solid waste are produced globally while huge amounts of energy are produced from fossil fuels, the technologies described in this comprehensive book provide the information necessary to pursue clean, sustainable power from waste material. Presents the latest advances in waste to energy techniques for converting solid waste to valuable fuel and energy Brings together contributors from physics, chemistry, metallurgy, engineering and the manufacturing industry Includes advanced techniques such as combustion, gasification, paralysis, anaerobic digestion and fermentation Goes far beyond municipal waste, including discussions on recouping valuable energy from a variety of industrial waste materials Describes how waste to energy technologies present an enormous opportunity for clean, sustainable energy

In the quest to mitigate the buildup of greenhouse gases in Earth's atmosphere, researchers and policymakers have increasingly turned their attention to techniques for capturing greenhouse gases such as carbon dioxide and methane, either from the locations where they are emitted or directly from the atmosphere. Once captured, these gases can be stored or put to use. While both carbon storage and carbon utilization have costs, utilization offers the opportunity to recover some of the cost and even generate economic value. While current carbon utilization projects operate at a relatively small scale, some estimates suggest the market for waste carbon-derived products could grow to hundreds of billions of dollars within a few decades, utilizing several thousand teragrams of waste carbon gases per year. Gaseous Carbon Waste Streams Utilization: Status and Research Needs assesses research and development needs relevant to understanding and improving the commercial viability of waste carbon utilization technologies and defines a research agenda to address key challenges. The report is intended to help inform decision making surrounding the development and deployment of waste carbon utilization technologies under a variety of circumstances, whether motivated by a goal to improve processes for making carbon-based products, to generate revenue, or to achieve environmental goals.

Energy recovery from waste resources holds a significant role in the sustainable waste management hierarchy to support the concept of circular economies and to mitigate the challenges of waste originated problems of sanitation, environment, and public health. Today, waste disposal to landfills is the most widely used methodology, particularly in developing countries, because of limited budgets and lack of efficient infrastructure and facilities to maintain efficient and practical global standards. As a consequence, the dump-sites or non-sanitary landfills have become the significant sources of greenhouse gases emissions, soil and water contamination, unpleasant odors, leachate, and disease spreading vectors, flies, and rodents. However, waste can be utilized to produce a range of potential products such as energy, fuels and value-added products under waste biorefineries. A holistic and quantitative view, such as waste biorefinery, on waste management must be linked to the actual country, taking into account its socio-economic situation, local waste sources, and composition, as well as the available markets for the recovered energy and products. Therefore, it is critical to understand that solutions cannot be just copied from one region to the others. In fact, all waste handling, transportation, and treatment can represent a burden to the cities' environment and macro and micro economics, except for the benefits obtained from recovered materials and energy. Equally significant is a clear and quantitative understanding of the industrial, and public potential of utilizing recovered materials and energy in the markets as these can be reached without exacerbating the environmental issues using excessive transport. The book explores new advancements and discoveries on the development of emerging waste-to-energy technologies, practical implementation, and lessons learned from sustainable wastemanagement practices under waste biorefinery concept, which will accelerate the growth of circular economies in the world. The articles presented in this book have been written by expert researchers and academics working in institutions at different countries across the world including Germany, Greece, Japan, South Korea, China, Saudi Arabia, Pakistan, Indonesia, Malaysia, Iran, and India. The research articles have been arranged into three main subject categories; 1) Resource recovery from waste, 2) Waste to energy technologies and 3) Waste biorefineries. This book will serve as an important resource for research students, academics, industry, policy makers, and government agencies working in the field of integrated waste management, energy and resource recovery, waste to energy technologies, waste biorefineries etc. The editorial team of this book is very grateful to all the authors for their excellent contributions and making the book successful.

Undoubtedly the applications of polymers are rapidly evolving. Technology is continually changing and quickly advancing as polymers are needed to solve a variety of day-to-day challenges leading to improvements in quality of life. The Encyclopedia of Polymer Applications presents state-of-the-art research and development on the applications of polymers. This groundbreaking work provides important overviews to help stimulate further advancements in all areas of polymers. This comprehensive multi-volume reference includes articles contributed from a diverse and global team of renowned researchers. It offers a broad-based perspective on a multitude of topics in a variety of applications, as well as detailed research information, figures, tables, illustrations, and references. The encyclopedia provides introductions, classifications, properties, selection, types, technologies, shelf-life, recycling, testing and applications for each of the entries where applicable. It features critical content for both novices and experts including, engineers, scientists (polymer scientists, materials scientists, biomedical engineers, macromolecular chemists), researchers, and students, as well as interested readers in academia,

industry, and research institutions.
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
Waste Biorefinery: Potential and Perspectives offers data-based information on the most cutting-edge processes for the utilisation of biogenic waste to produce biofuels, energy products, and biochemicals – a critical aspect of biorefinery. The book explores recent developments in biochemical and thermo-chemical methods of conversion and the potential generated by different kinds of biomass in more decentralized biorefineries. Additionally, the book discusses the move from 200 years of raw fossil materials to renewable resources and how this shift is accompanied by fundamental changes in industrial manufacturing technologies (from chemistry to biochemistry) and in logistics and manufacturing concepts (from petrochemical refineries to biorefineries). Waste Biorefinery: Potential and Perspectives designs concepts that enable modern biorefineries to utilize all types of biogenic wastes, and to integrate processes that convert byproduct streams to high-value products, achieving higher cost benefits. This book is an essential resource for researchers and students studying biomass, biorefineries, and biofuels/products/processes, as well as chemists, biochemical/chemical engineers, microbiologists, and biotechnologists working in industries and government agencies. Details the most advanced and innovative methods for biomass conversion Covers biochemical and thermo-chemical processes as well as product development Discusses the integration of technologies to produce bio-fuels, energy products, and biochemicals Illustrates specific applications in numerous case studies for reference and teaching purposes
Bachelor Thesis from the year 2012 in the subject Engineering - Chemical Engineering, Wollo University (Kombolcha Institute Of Technology), course: Chemical Engineering , language: English, abstract: Abstract: The objective of the work is the conversion of waste plastics into fuel oil. Plastic wastes such as, polypropylene, low density polyethylene, high density polyethylene, polystyrene are the most frequently used in everyday activities and disposed of to the environment after service. Plastic are those substances which can take long periods of time to decompose if disposed off simply to the environment. Therefore, waste plastic should be changed into usable resources. The different waste plastics were thermally cracked at different temperature and then it was tried to measure the oil produced, the residue left after the reaction is completed, and the gas produced. Then it is compared that which types of plastics can yield higher amount of oil. There are a number of methods by which plastic wastes can be managed such as incineration, recycling, land filling, and thermal cracking. But this work focuses on thermal cracking of waste plastic to change them into usable resources, because in this method the emission of hazardous gases to the environment insignificant. This means we can change all the waste in to useful resources. Keywords: liquid oil, thermal cracking, and waste management system
This book presents an overview of the technology that allows millions and millions of tons of municipal solid waste generated globally to be perceived as an asset which, after materials recovery for recycling, can be used to generate clean power, transport fuels that can substitute fossil fuels, and value-based chemicals with minimal environmental impact. It also explains how hazardous wastes and sewage sludge can be treated and disposed of without affecting human and environmental health. It does so by providing a full discussion of established thermal conversion technologies generating heat, electricity, liquid fuels and useful chemicals from solid waste. Featuring case studies describing worldwide waste-to-energy plants in successful operation, it offers highly suited supporting material for an introductory course on waste thermal conversion processes.
With the huge amount of plastics floating in the oceans, fish and other sea creatures are directly suffering the consequences. On land, city leaders and planners are banning one-use plastics as well as plastic bags from grocery stores in an effort to stem the use. Many countries have made official announcements and warnings concerning the pollution caused from plastic wastes. These urgent developments have stimulated the author to study the problem and write Polymer Waste Management. Plastic recycling refers to a method that retrieves the original plastic material. However, there are many sophisticated methods available for the treatment and management of waste plastics such as basic primary recycling, where the materials are sorted and collected individually. In chemical recycling, the monomers and related compounds are processed by special chemical treatments. Other methods, such as pyrolysis, can produce fuels from waste plastics. These methods and others are treated comprehensively in the book This ground-breaking book also discusses: General aspects, such as amount of plastics production, types of waste plastics, analysis procedures for identification of waste plastic types, standards for waste treatment, contaminants in recycled plastics. Environmental aspects, such as pollution in the marine environment and landfills. The advantages of the use of bio-based plastics. Recycling methods for individual plastic types and special catalysts.
The book focuses on a global issue—municipal solid waste management (MSWM) and presents the most effective solutions based on energy recovery processes. There is huge potential in employing different technologies and modern management methodology for recovering energy from various waste streams to establish a sustainable and circular economy. In several countries, energy recovery from municipal solid wastes (MSW) is seen as a way of reducing the negative impact of waste on the environment and also reducing the burden on land resources. The book primarily focuses on highlighting the latest insights into energy recovery from various waste streams in different countries, with a particular emphasis on India. Further, it paves the way for sustainability in the energy sector as a whole by addressing waste management issues and simultaneous energy recovery. The chapters present high-quality research papers selected and presented in the conference, IconSWM 2018.

Feedstock Recycling and Pyrolysis of Waste PlasticsConverting Waste Plastics Into Diesel and Other FuelsJohn Wiley & Sons Incorporated

This book focuses on starch polymers including starch genetics, biotechnological and chemical modification, nanostructures, processing, characterization, properties and applications. This books topic is in a cutting edge and emerging technology area of biomaterials, nanomaterials and renewable materials, and will involve international experts in diverse fields from genetic engineering to applications. Focuses on cutting edge applications of starch polymers, including starch genetics and Rheology Contains working examples and provides real problems and solutions in the area of biomaterials, nanomaterials, and renewable materials Provides systematic and in-depth coverage and critical assessment of all starch properties and applications from top scientists in the industry

This book is part of a two-volume work that offers a unique blend of information on realistic evaluations of catalyst-based synthesis processes using green chemistry principles and the environmental sustainability applications of such processes for biomass conversion, refining, and petrochemical production. The volumes provide a comprehensive resource of state-of-the-art technologies and green chemistry methodologies from researchers, academics, and chemical and manufacturing industrial scientists. The work will be of interest to professors, researchers, and practitioners in clean energy catalysis, green chemistry, chemical engineering and manufacturing, and environmental sustainability. This volume focuses on the potentials, recent advances, and future prospects of catalysis for biomass conversion and value-added chemicals production via green catalytic routes. Readers are presented with a mechanistic framework assessing the development of product selective catalytic processes for biomass and biomass-derived feedstock conversion. The book offers a unique combination of contributions from experts working on both lab-scale and industrial catalytic processes and provides insight into the use of various catalytic materials (e.g., mineral acids, heteropolyacid, metal catalysts, zeolites, metal oxides) for clean energy production and environmental sustainability.

A comprehensive reference to the use of innovative catalysts and processes to turn biomass into value-added chemicals Chemical Catalysts for Biomass Upgrading offers detailed descriptions of catalysts and catalytic processes employed in the synthesis of chemicals and fuels from the most abundant and important biomass types. The contributors?noted experts on the topic?focus on the application of catalysts to the pyrolysis of whole biomass and to the upgrading of bio-oils. The authors discuss catalytic approaches to the processing of biomass-derived oxygenates, as exemplified by sugars, via reactions such as reforming, hydrogenation, oxidation, and condensation reactions. Additionally, the book provides an overview of catalysts for lignin valorization via oxidative and reductive methods and considers the conversion of fats and oils to fuels and terminal olefins by means of esterification/transesterification, hydrodeoxygenation, and decarboxylation/decarbonylation processes. The authors also provide an overview of conversion processes based on terpenes and chitin, two emerging feedstocks with a rich chemistry, and summarize some of the emerging trends in the field. This important book: -Provides a comprehensive review of innovative catalysts, catalytic processes, and catalyst design -Offers a guide to one of the most promising ways to find useful alternatives for fossil fuel resources -Includes information on the most abundant and important types of biomass feedstocks -Examines fields such as catalytic cracking, pyrolysis, depolymerization, and many more Written for catalytic chemists, process engineers, environmental chemists, bioengineers, organic chemists, and polymer chemists, Chemical Catalysts for Biomass Upgrading presents deep insights on the most important aspects of biomass upgrading and their various types.

Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Volume 2: Chemical Processes is the second of two volumes by the editors (the first volume is Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Biological Processes). This volume presents advanced techniques and combined techniques used to convert energy to waste, including combustion, gasification, paralysis, anaerobic digestion and fermentation. The title focuses on solid waste conversion to fuel and energy, presenting advances in the design, manufacture and application of conversion technologies. Contributors from physics, chemistry, metallurgy, engineering and manufacturing present a truly trans-disciplinary picture of waste to energy conversion. Huge volumes of solid waste are produced globally while, at the same time, huge amounts of energy are produced from fossil fuels. Waste to energy (WTE) technologies are developing rapidly, holding out the potential to make clean, sustainable power from waste material. These WTE procedures incorporate various methods and blended approaches, and present an enormous opportunity for clean, sustainable energy. Presents the latest advances in waste to energy techniques for converting solid waste to valuable fuel and energy Brings together contributors from physics, chemistry, metallurgy, engineering and the manufacturing industry Includes advanced techniques such as combustion, gasification, paralysis, anaerobic digestion and fermentation Goes far beyond municipal waste, including the recouping of valuable energy from a variety of industrial waste materials

Considering the deleterious impacts of fossil fuels on the environmental and natural ecosystems, it has become imperative to make a paradigm shift toward renewable fuels, chemicals, and materials. The exhaustive everyday usage of fossil fuels and processed petrochemical products are the leading causes for the increase in greenhouse gas emissions, global warming, climate changes, acid rain, ozone layer depletion, pollution of air, water, and soil as well as for the accumulation of nonbiodegradable materials in the soil and oceans. On the contrary, biofuels, biochemicals, and biomaterials derived from renewable wastes such as nonedible plant biomass (e.g., agricultural and forestry biomass), energy crops, microalgae, municipal solid waste, sewage sludge, and other biogenic residues seem to be carbon neutral. Therefore, the global interest in biorefining technologies, especially thermochemical and biological conversion processes, is gaining momentum in academic and industrial perspectives. Progressive Thermochemical Biorefining Technologies offers all-inclusive coverage of the most crucial topics as follows: State-of-the-art information on the production and utilization of biofuels through thermochemical biorefining technologies Conversion of waste biomass through pyrolysis, liquefaction, torrefaction, carbonization, gasification, reforming, and other clean technologies Waste-to-energy/chemical generation Fuel upgrading technologies Techno-economic analysis and life-cycle assessment of biorefining processes Specifically designed to be instantly applicable, this volume serves as a reference book for undergraduate and graduate students, scientific investigators, and research scholars working in the areas relating to energy and fuels.

Biomass is the only renewable carbon source that can be converted into high value-added carbon products. This book presents a collection of studies on the conversion of catalytic biomass to renewable biofuels and biomaterials by chemical conversion, co-combustion technology, and biological conversion technology. The fundamentals and mechanisms of catalytic materials design, process optimization, product development, and by-product utilization are outlined. All articles were contributed by experts in catalysis and bioenergy fields to provide readers with a

broad range of perspectives on cutting-edge applications. This book is an ideal reference guide for academic researchers and engineering technicians in the fields of catalytic material synthesis, biomass energy conversion, enzyme catalysis, pyrolysis, combustion, vaporization, and fermentation. It can also be used as a comprehensive reference source for university students in renewable energy science and engineering, agricultural engineering, thermal engineering, chemical engineering, material science, and environmental engineering. This book contains 12 articles: (1) “Catalytic Biomass to Renewable Biofuels and Biomaterials”; (2) “Experimental Design to Improve Cell Growth and Ethanol Production in Syngas Fermentation by Clostridium carboxidivorans”; (3) “Glycerol Acetylation Mediated by Thermally Hydrolysed Biosolids-Based Material”; (4) “Influence of Base-Catalyzed Organosolv Fractionation of Larch Wood Sawdust on Fraction Yields and Lignin Properties”; (5) “Ca-based Catalysts for the Production of High-Quality Bio-Oils from the Catalytic Co-Pyrolysis of Grape Seeds and Waste Tyres”; (6) “Synthesis of Diesel and Jet Fuel Range Cycloalkanes with Cyclopentanone and Furfural”; (7) “Gel-Type and Macroporous Cross-Linked Copolymers Functionalized with Acid Groups for the Hydrolysis of Wheat Straw Pretreated with an Ionic Liquid”; (8) “Role of Humic Acid Chemical Structure Derived from Different Biomass Feedstocks on Fe(III) Bioreduction Activity: Implication for Sustainable Use of Bioresources”; (9) “Selective Production of Terephthalonitrile and Benzonitrile via Pyrolysis of Polyethylene Terephthalate (PET) with Ammonia over Ca(OH)2/Al2O3 Catalysts”; (10) “Experimental Studies on Co-Combustion of Sludge and Wheat Straw”; (11) “Carbonate-Catalyzed Room-Temperature Selective Reduction of Biomass-Derived 5-Hydroxymethylfurfural into 2,5-Bis(hydroxymethyl)furan”; (12) “Clostridium sp. as Bio-Catalyst for Fuels and Chemicals Production in a Biorefinery Context”.

The utilization of various types of biomass residue to produce products such as biofuels and biochemicals means biorefinery technology using biomass residues may become a one-stop solution to the increasing need for sustainable, non-fossil sources of energy and chemicals. Refining Biomass Residues for Sustainable Energy and Bioproducts: Technology, Advances, Life Cycle Assessment and Economics focuses on the various biorefineries currently available and discusses their uses, challenges, and future developments. This book introduces the concept of integrated biorefinery systems, as well as their operation and feedstock sourcing. It explores the specificities, current developments, and potential end products of various types of residue, from industrial and municipal to agricultural and marine, as well as residue from food industries. Sustainability issues are discussed at length, including life cycle assessment, economics, and cost analysis of different biorefinery models. In addition, a number of global case studies examine successful experiences in different regions. This book is an ideal resource for researchers and practitioners in the field of bioenergy and waste management who are looking to learn about technologies involved in residue biorefinery systems, how to reduce their environmental impacts, and how to ensure their commercial viability. Explores a range of different biorefinery categories, such as industrial, agricultural, and marine biomass residues Includes a Life Cycle Assessment of biorefinery models, in addition to costs and market analysis. Features case studies from around the world and is written by an international team of authors

A comprehensive, interdisciplinary picture of how lignocellulosic biorefineries could potentially employ lignin valorization technologies.

The concept of sustainability is already applied in all industrial sectors. The fight against climate change therefore forces us to look for alternatives in the way we move. Different alternative fuels are discussed in this book: from liquid and gaseous biofuels to electricity. Moreover, waste to fuel processes are another option to produce a significant amount of fuels. In the spirit of this book, there is not only collecting different alternatives, but creativity is also promoted in the readers of this book, so that they take an active part of the solution necessary to reduce greenhouse gas emissions.

This book presents the latest advances in and current research perspectives on the field of urban/industrial solid waste recycling for bio-energy and bio-fuel recovery. It chiefly focuses on five main thematic areas, namely bioreactor landfills coupled with energy and nutrient recovery; microbial insights into anaerobic digestion; greenhouse emission assessment; pyrolysis techniques for special waste treatment; and industrial waste stabilization options. In addition, it compiles the results of case studies and solid waste management perspectives from different countries.

This book introduces advanced or emerging technologies for conversion of wastes into a variety of high-value chemicals and materials. Energy and resources can be recovered from various residential, industrial and commercial wastes, such as municipal wastewater and sludge, e-waste, waste plastics and resins, crop residues, forestry residues and lignin. Advanced waste-to-resource and energy technologies like pyrolysis, hydrothermal liquefaction, fractionation, de-polymerization, gasification and carbonization are also introduced. The book serves as an essential guide to dealing with various types of wastes and the methods of disposal, recovery, recycling and re-use. As such it is a valuable resource for a wide readership, including graduate students, academic researchers, industrial researchers and practitioners in chemical engineering, waste management, waste to energy and resources conversion and biorefinery.

A noval low-temperature catalytic recycling process as been investigated for use in reclaiming plastics and composite materials. The plastics and composites were selected to be representative of those used in Air Force aircraft and munitions. Results show that all types of plastics, thermosets as well as thermoplastics, can be converted in high yields to valuable hydrocarbon products with this novel catalytic conversion process. Conversion times are rapid and the process is closed and, thus, nonpolluting. Additional tests on used plastic blast media, a hazardous waste stream, and composite materials demonstrate the utility of the low-temperature catalytic conversion process. Catalytic conversion of used plastic blast media removed the organic components and reduced the volume of hazardous material by a factor of 5. In that form, the remaining heavy metal oxides can be resmelted, eliminating the hazardous waste stream. Epoxy, polyester, imide, and engineering thermoplastic composite matrices are converted into low molecular weight hydrocarbons leaving valuable fibers behind that can be reused to fabricate additional composite materials. Economic projections show that a recycling plant based on this process will pay for itself in one to two years. A related technology has been demonstrated on a large scale (100 tons/day) for recycling used tires, which shows that there is a high probability for success with large-scale tertiary recycling of plastics and composites.

This report examines the issue of converting plastics waste into energy and/or useful chemicals. Much plastic material is discarded as waste, such as packaging and end-of-life vehicle components. This report introduces the different waste management options. It discusses the methods available for treating mixed plastics waste and PVC-rich plastics waste. The emphasis in this report is on technologies which are already being used or assessed for use on a commercial scale. Comparisons are made between the different types of recycling currently available in terms of life cycle assessment and environmental impact. Feedstock recycling is discussed extensively in this review. This report is accompanied by around 400 abstracts from papers in the Rapra Polymer Library database.

The use of plastic materials has seen a massive increase in recent years, and generation of plastic wastes has grown proportionately. Recycling of these wastes to reduce landfill disposal is problematic due to the wide variation in properties and chemical composition among the different types of plastics. Feedstock recycling is one of the alternatives available for consideration, and Feedstock Recycling of Plastic Wastes looks at the conversion of plastic wastes into valuable chemicals useful as fuels or raw materials. Looking at both scientific and technical aspects of the recycling developments, this book describes

the alternatives available. Areas include chemical depolymerization, thermal processes, oxidation and hydrogenation. Besides conventional treatments, new technological approaches for the degradation of plastics, such as conversion under supercritical conditions and coprocessing with coal are discussed. This book is essential reading for those involved in plastic recycling, whether from an academic or industrial perspective. Consultants and government agencies will also find it immensely useful.

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. Presents actionable solutions for reducing plastic waste, with a focus on the concepts of collection, re-use, recycling and replacement Considers major societal and environmental issues, providing the reader with a broader understanding and supporting effective implementation Includes detailed case studies from across the globe, offering unique insights into different solutions and approaches

This book discusses soil and recycling management in the Anthropocene era. Nitrogen shortage is one of nature’s most important productivity regulators, but since the advent of technical nitrogen fixation (TNF), biological nitrogen fixation (BNF) input has nearly doubled, particularly in grass and arable lands covering over 13 million km2 of the Earth’s surface. This book explores how monoculture grass, arable lands and forests are often over fertilized with TNF, animal slurries, sewage sludge, or municipally produced composts, and as a result, flora and fauna that have adapted to a nitrogen shortage in the soil will have to adjust to a surplus; those that are unable to adapt will disappear.