

Reading free High energy materials propellants explosives and pyrotechnics (PDF)

authored by an insider with over 40 years of high energy materials hems experience in academia industry and defense organizations this handbook and ready reference covers all important hems from the 1950s to the present with their respective properties and intended purposes written at an attainable level for professionals engineers and technicians alike the book provides a comprehensive view of the current status and suggests further directions for research and development an introductory chapter on the chemical and thermodynamic basics allows the reader to become acquainted with the fundamental features of explosives before moving on to the important safety aspects in processing handling transportation and storage of high energy materials with its collation of results and formulation strategies hitherto scattered in the literature this should be on the shelf of every hem researcher and developer hier meldet sich ein wahrer insider zu wort Über 40 jahre erfahrung aus der industriellen und akademischen forschung und der arbeit für verteidigungsorganisationen kondensiert der autor in diesem leitfaden der spreng und explosivstoffe the 4th revised edition expands on the basic chemistry of high energy materials of the precious editions and examines new research developments including hydrodynamics and ionic liquids applications in military and civil fields are discussed this work is of interest to advanced students in chemistry materials science and engineering as well as to all those working in defense technology provides an up to date account of innovative energetic materials and their potential applications in space propulsion and high explosives most explosives and propellants currently use a small number of ingredients such as tnt and nitrocellulose in comparison to conventional materials nano and micro scale energetic materials exhibit superior burning characteristics and much higher energy densities and explosive yields nano and micro scale energetic materials propellants and explosives provides a timely overview of innovative nano scale energetic materials nems and microscale energetic materials μ ems technology covering nems and μ ems ingredients as well as formulations this comprehensive volume examines the preparation characterization ignition combustion and performance of energetic materials in various applications of propellants and explosives twenty two chapters explore metal based pyrotechnic nanocomposites solid and hybrid rocket propulsion solid fuels for in space and power the sensitivity and mechanical properties of explosives new energetic materials and more explores novel energetic materials and their potential for use in propellants and explosives summarizes the most recent advances of leading research groups currently active in twelve countries discusses how new environmentally friendly high combustion energetic materials can best be used in different applications explains the fundamentals of energetic materials including similarities and differences between composite propellants and explosives nano and micro scale energetic materials propellants and explosives is an important resource for materials scientists explosives specialists pyrotechnicians environmental chemists polymer chemists physical chemists aerospace physicians and aerospace engineers working in both academia and industry this edited book contains state of the art information associated with energetic material combustion there are twelve topical areas including reaction kinetics of energetic materials solid liquid and gel propellants recycling of energetic materials combustion performance of hybrid and solid rocket motors ignition and combustion of energetic materials energetic material defects and rocket engine flowfields metal combustion pyrolysis and combustion processes of new ingredients and applications theoretical modeling and numerical simulation of combustion processes of energetic materials combustion diagnostic techniques propellant and rocket motor stability commercial applications of energetic materials airbags gas generators etc and thermal insulation and ablation processes demystifying explosives concepts in high energy materials explains the basic concepts of and the science behind the entire spectrum of high energy materials hems and gives a broad perspective about all types of hems and their interrelationships demystifying explosives covers topics ranging from explosives deflagration detonation and pyrotechnics to safety and security aspects of hems looking at their aspects particularly their inter relatedness with respect to properties and performance the book explains concepts related to the molecular structure of hems their properties performance parameters detonation and shock waves including explosives and propellants the theory based title also deals with important safety and security and interesting constructive applications aspects connected with hems and is of fundamental use to students in their introduction to these materials and applications explains the concept of high energy materials in simple language and

down to earth examples worked examples and problems are given wherever required demystifies the concept of explosives limited use of big and complex equations questions and suggested reading are given at the end of each chapter provides an up to date account of innovative energetic materials and their potential applications in space propulsion and high explosives most explosives and propellants currently use a small number of ingredients such as tnt and nitrocellulose in comparison to conventional materials nano and micro scale energetic materials exhibit superior burning characteristics and much higher energy densities and explosive yields nano and micro scale energetic materials propellants and explosives provides a timely overview of innovative nano scale energetic materials nems and microscale energetic materials μ ems technology covering nems and μ ems ingredients as well as formulations this comprehensive volume examines the preparation characterization ignition combustion and 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and aerospace engineers working in both academia and industry this book focuses on the combustion performance and application of innovative energetic materials for solid and hybrid space rocket propulsion it provides a comprehensive overview of advanced technologies in the field of innovative energetic materials and combustion performance introduces methods of modeling and diagnosing the aggregation agglomeration of active energetic metal materials in solid propellants and investigates the potential applications of innovative energetic materials in solid and hybrid propulsion in addition it also provides step by step solutions for sample problems to help readers gain a good understanding of combustion performance and potential applications of innovative energetic materials in space propulsion this book serves as an excellent resource for researchers and engineers in the field of propellants explosives and pyrotechnics modern energetic materials include explosives blasting powders pyrotechnic m tures and rocket propellants 1 2 the study of high temperature decomposition of condensed phases of propellants and their components liquid solid and hybrid is currently of special importance for the development of space system engineering 3 4 to better understand the burning mechanisms stationary nonstationary steady of composite solid propellants and their components information about the macrokinetics of their high temperature decomposition is required 5 to be able to evaluate the ignition parameters and conditions of safe handling of heat affected explosives one needs to know the kinetic constants of their high temperature composition the development of new composite solid propellants characterized by high performance characteristics high burning rates high thermal stability stability to intrachamber perturbations and other aspects is not possible without quanti tive data on the high temperature decomposition of composite solid propellants and their components 6 the same reasons have resulted in signi cant theoretical and practical interest in the high temperature decomposition of components of hybrid propellants it is known that hybrid propellants have not been used very widely due to the low bu ing pyrolysis rates of the polymer blocks in the combustion chambers of hybrid rocket engines to increase the burning rates it is necessary to obtain information about their relationships to the corresponding kinetic and thermophysical prop ties of the fuels this volume provides an overview of current research and recent advances in the area of energetic materials focusing on explosives and propellants the contents and format reflect the fact that theory experiment and computation are closely linked in this field the challenge of developing energetic materials that are less sensitive to accidental stimuli continues to be of critical importance this volume opens with discussions of some determinants of sensitivity and its correlations with various molecular and crystal properties the next several chapters deal in considerable detail with different aspects and mechanisms of the initiation of detonation and its quantitative description the second half of this volume focuses upon combustion extensive studies model ignition and combustion with applications to different propellants the final chapter is an exhaustive computational treatment of the mechanism and kinetics of combustion initiation reactions of ammonium perchlorate overall this volume illustrates the progress that has been made in the field of energetic materials and some of the areas of current activity it also indicates the challenges involved in characterizing and understanding the properties and behaviour of these compounds the work is a unique state of the art treatment of the subject written by pre eminent researchers in the field overall emphasis is on theory and computation presented in the

context of relevant experimental work presents a unique state of the art treatment of the subject contributors are preeminent researchers in the field incorporation of particular components with specialized properties allows one to tailor the end product s properties for instance the sensitivity burning behavior thermal or mechanical properties or stability of energetic materials can be affected and even controllably varied through incorporation of such ingredients this book examines particle technologies as applied to energetic materials such as propellants and explosives thus filling a void in the literature on this subject following an introduction covering general features of energetic materials the first section of this book describes methods of manufacturing particulate energetic materials including size reduction crystallization atomization particle formation using supercritical fluids and microencapsulation agglomeration phenomena special considerations in mixing explosive particles and the production of nanoparticles the second section discusses the characterization of particulate materials techniques and methods such as particle size analysis morphology elucidation and the determination of chemical and thermal properties are presented the wettability of powders and rheological behavior of suspensions and solids are also considered furthermore methods of determining the performance of particular energetic materials are described each chapter deals with fundamentals and application possibilities of the various methods presented with particular emphasis on issues applicable to particulate energetic materials the book is thus equally relevant for chemists physicists material scientists chemical and mechanical engineers and anyone interested or engaged in particle processing and characterization technologies this comprehensive book presents a detailed account of research and recent developments in the field of green energetic materials including pyrotechnics explosives and propellants this area is attracting increasing interest in the community as it undergoes a transition from using traditional processes to more environmentally friendly procedures the book covers the entire line of research from the initial theoretical modelling and design of new materials to the development of sustainable manufacturing processes it also addresses materials that have already reached the production line as well as considering future developments in this evolving field this third edition of the classic on the thermochemical aspects of the combustion of propellants and explosives is completely revised and updated and now includes a section on green propellants and offers an up to date view of the thermochemical aspects of combustion and corresponding applications clearly structured the first half of the book presents an introduction to pyrodynamics describing fundamental aspects of the combustion of energetic materials while the second part highlights applications of energetic materials such as propellants explosives and pyrolants with a focus on the phenomena occurring in rocket motors finally an appendix gives a brief overview of the fundamentals of aerodynamics and heat transfer which is a prerequisite for the study of pyrodynamics a detailed reference for readers interested in rocketry or explosives technology advanced energetic materialsâ explosive fill and propellantsâ are a critical technology for national security while several new promising concepts and formulations have emerged in recent years the department of defense is concerned about the nation s ability to maintain and improve the knowledge base in this area to assist in addressing these concerns two offices within dod asked the nrc to investigate and assess the scope and health of the u s r d efforts in energetic materials this report provides that assessment it presents several findings about the current r d effort and recommendations aimed at improving u s capabilities in developing new energetic materials technology this study reviewed u s research and development in advanced energetics being conducted by dod the doe national laboratories industries and academia from a list provided by the sponsors it also a reviewed papers and technology assessments of non u s work in advanced energetics assessed important parameters such as validity viability and the likelihood that each of these materials can be produced in quantity b identified barriers to scale up and production and suggested technical approaches for addressing potential problems and c suggested specific opportunities strategies and priorities for government sponsorship of technologies and manufacturing process development this book offers a comprehensive account of energetic materials including their synthesis computational modeling applications associated degradation mechanisms environmental consequences and fate and transport this multi author contributed volume describes how armed forces around the world are moving their attention from legacy explosive compounds which are heat and shock sensitive thus posing greater challenges in terms of handling and storage to the insensitive munitions compounds formulations such as insensitive munitions explosive imx and the picatinny arsenal explosive pax series of compounds the description of energetic materials focuses on explosives pyrotechnic compositions and propellants the contributors go on to explain how modern generation energetic compounds must be insensitive to shock and heat but at the same time yield more energy upon explosion nanoinspired and or co crystallized energetic materials offer another route to generate next generation energetic materials and this authoritative book bridges a large gap in the literature by providing a comprehensive analysis of these compounds additionally it includes a valuable overview of energetic

materials a detailed discussion of recent advances on future energetic compounds nanotechnology in energetic materials environmental contamination and toxicity assessment of munitions lethality the application quantitative structure activity relationship qsar in design of energetics and the fate and transport of munition compounds in the environment in the last decade there has been an influx in the development of new technologies for deep space exploration countries all around the world are investing in resources to create advanced energetic materials and propulsion systems for their aerospace initiatives energetic materials research applications and new technologies is an essential reference source of the latest research in aerospace engineering and its application in space exploration featuring comprehensive coverage across a range of related topics such as molecular dynamics rocket engine models propellants and explosives and quantum chemistry calculations this book is an ideal reference source for academicians researchers advanced level students and technology developers seeking innovative research in aerospace engineering this book represents a collection of lectures presented at the nato advanced study institute asi on chemistry physics of the molecular processes in energetic materials held at hotel torre normanna altavilla milicia sicily italy september 3 to 15 1989 the institute was attended by seventy participants including twenty lecturers drawn from thirteen countries the purpose of the institute was to review the major advances made in recent years in the theoretical and experimental aspects of explosives and propellants in accordance with the format of the nato asi it was arranged to have a relatively small number of speakers to present in depth review type lectures emphasizing the basic research aspects of the subject over a two week period most of the speakers gave two lectures each in excess of one hour with additional time for discussions the scope of the meeting was limited to molecular and spectroscopic studies since the hydrodynamic aspects of detonation and various performance criteria of energetic materials are often covered adequately in other international meetings an attempt was made to have a coherent presentation of various theoretical computational and spectroscopic approaches to help a better understanding of energetic materials from a molecular point of view the progress already made in these areas is such that structure property e g metal fluorocarbon based energetic materials this exciting new book details all aspects of a major class of pyrolants and elucidates the progress that has been made in the field covering both the chemistry and applications of these compounds written by a pre eminent authority on the subject from the nato munitions safety information analysis center msiac it begins with a historical overview of the development of these materials followed by a thorough discussion of their ignition combustion and radiative properties the next section explores the multiple facets of their military and civilian applications as well as industrial synthetic techniques the critical importance of the associated hazards namely sensitivity stability and aging are discussed in detail and the book is rounded off by an examination of the future of this vital and expanding field the result is a complete guide to the chemistry manufacture applications and required safety precautions of pyrolants for both the military and chemical industries from the preface this book fills a void in the collection of pyrotechnic literature it will make an excellent reference book that all researchers of pyrolants and energetics must have dr bernard e doula dr sara pliskin navsea crane in usa В основе учебного пособия лежит идея взаимосвязанного и одновременного развития профессиональных и коммуникативных языковых компетенций необходимых в профессиональном общении будущих специалистов в области высокоэнергетических материалов Цель пособия подвести студентов к чтению оригинальной литературы по специальности и ведению беседы на темы предусмотренные программой языковой подготовки третьего поколения the study of energetic materials is emerging from one primarily directed toward practical interests to an advanced area of fundamental research where state of the art methods and theory are used side by side with modern synthetic methods this timely book integrates the recent experimental synthetic and theoretical research of energetic materials editors george olah and david squire emphasize the importance of structure and mechanism in determining properties and performances they also explore new spectrometric methods and synthetic approaches in this useful reference discusses structural analysis by x ray crystallography explains chemical dynamics by photofragmentation translational spectroscopy covers kinetic analysis by ultrafast absorption and emission spectroscopy details syntheses of polycyclic caged amines fuel additives and polynitro compounds examines computer aided design of monopropellants includes contributions by two nobel laureates and five members of the national academy of sciences developed and expanded from the work presented at the new energetic materials and propulsion techniques for space exploration workshop in june 2014 this book contains new scientific results up to date reviews and inspiring perspectives in a number of areas related to the energetic aspects of chemical rocket propulsion this collection covers the entire life of energetic materials from their conceptual formulation to practical manufacturing it includes coverage of theoretical and experimental ballistics performance properties as well as laboratory scale and full system scale handling hazards environment

ageing and disposal chemical rocket propulsion is a unique work where a selection of accomplished experts from the pioneering era of space propulsion and current technologists from the most advanced international laboratories discuss the future of chemical rocket propulsion for access to and exploration of space it will be of interest to both postgraduate and final year undergraduate students in aerospace engineering and practicing aeronautical engineers and designers especially those with an interest in propulsion as well as researchers in energetic materials the book is a treatise on solid propellants in nine chapters covering the history chemistry energetics processing and characterization aspects of composite solid propellants internal ballistics advanced solid propellants safety quality and reliability and homogenous or double base propellants the book also traces the evolution of solid propellant technology in isro for launch vehicles and sounding rockets there is a detailed table of contents expanded index glossary exhaustive references and questions in each chapter it can be used as a textbook for science and engineering students as a reference book for researchers and as a companion to scientists and engineers working in the research development and production areas of solid propellants this dictionary contains 739 entries with about 1400 references to the primary literature details on the composition performance sensitivity and other pertinent properties of energetic materials such as high explosives propellants pyrotechnics as well as important ingredients such as oxidizers fuels binders and modifiers are given and presented partly in over 180 tables with more than 240 structural formulas in detail the dictionary gives elaborate descriptions of 460 chemical substances 170 pyrotechnic compositions 360 high explosive and propellant formulations in addition the basic physical and thermochemical properties of 435 pure substances elements compounds typically occurring as ingredients or reaction products are given too 150 figures schemes and diagrams explain applications test methods scientific facilities and finally individuals closely tied with the development and investigation of energetic materials the book is intended for readers with a technical or scientific background active in governmental agencies research institutes trade and industry concerned with the procurement development manufacture investigation and use of energetic materials such as high explosives propellants pyrotechnics fireworks and ammunition the book serves both as a daily reference for the experienced as well as an introduction for the newcomer to the field few books cover experimental and theoretical methods to characterize decomposition combustion and detonation of energetic materials this volume by internationally known and major contributors to the field is unique because it summarizes the most important recent work what we know with confidence and what main areas remain to be investigated most chapters comprise summaries of work spanning decades and contain expert commentary available nowhere else although energetic materials are its focus this book provides a guide to modern methods for investigations of condensed and gas phase reactions although these energetic reactions are complex and difficult to study the work discussed here provides readers with a substantial understanding of the behavior of materials now in use and a predictive capability for the development of new materials based on target properties contents connecting molecular properties to decomposition combustion and explosion trends t b brill thermal decomposition processes of energetic materials in the condensed phase at low and moderate temperatures r behrens study of energetic material combustion chemistry by probing mass spectrometry and modeling of flames o p korobeinichev optical spectroscopic measurements of energetic material flame structure t parr d hanson parr transient gas phase intermediates in the decomposition of energetic materials p j dagdigian role of excited electronic states in the decomposition of energetic materials e r bernstein gas phase kinetics for propellant combustion modeling requirements and experiments w r anderson a fontijn gas phase decomposition of energetic molecules d l thompson modeling the reactions of energetic materials in the condensed phase l e fried et al multi phonon up pumping in energetic materials d d dlott applications of theoretical chemistry in assessing energetic materials for performance or sensitivity b m rice combustion and ignition of nitramine propellants aspects of modeling simulation and analysis e s kim v yang burning rate models and their successors a personal perspective m s miller ideas to expand thinking about new energetic materials j bottaro readership researchers studying fast chemical reactions and materials behavior under extreme conditions experts and beginners in energetic decomposition combustion and detonation research keywords energetic materials combustion thermal decomposition combustion model materials design flames explosive propellant computational chemistry detonationkey features summarizes the known knowns the most important recent work and lists the known unknowns what remains to be investigated provides expert commentary on the complex behavior of materialsreviews this book nicely covers the application of many experimental and theoretical tools to study the difficult problem of ignition and combustion of many traditional energetic materials it could be a valuable resource to the researchers in the field journal of the american chemical society this unique book investigates the synthesis kinetics and thermal decomposition properties and processing of energy producing materials used in propellants explosives pyrotechnic and gas generating

compositions thermal decomposition and combustion of explosives and propellants provides several mechanisms and stages for the thermal decomposition and combustion reactions of most flammable compounds and their mixtures such as aliphatic and aromatic nitrocompounds nitramines nitroesters organic azides furazanes tetrazols difluoroamines polynitrous heterocycles and onium salts the authors examine the classic problem of the dependence of explosive activity on molecular structure using applications to predict the stability compatibility and the stabilization of explosives and propellant components they also offer experimental results examining factors such as subsurface decomposition evaporation and dispersion of materials which can be used to control combustion of condensed systems providing several approaches to stability safety and controlled combustion of flammable substances thermal decomposition and combustion of explosives and propellants is a multi dimensional resource for graduate students researchers and professionals interested in chemical kinetics the combustion and synthesis of high energy materials criminal forensics and the field of explosives powders and solid rocket propellants the energetic materials encyclopedia is a compendium of pure energetic materials i e not formulations which summarizes the most important parameters of these compounds the impact friction and electrostatic discharge esd sensitivity parameters are reported thermal parameters such as the melting points and decomposition temperatures are also given together with the thermodynamic enthalpies of formation the density values that govern the detonation performance are given for the theoretical maximum density tmd and where appropriate also for lower densities the most important performance parameters such as the detonation pressure the detonation velocity as well as the temperature of explosion and the heat of explosion are also stated wherever possible experimental values are given together with calculated parameters if multiple values for one property were available from the literature these are also stated e g 20 different detonation velocities for rdx for all literature values the original references have been included the energetic materials encyclopedia will be of interest for advanced students of chemistry materials science engineering and professionals in military technology this volume provides an overview of current research and recent advances in the area of energetic materials focusing on decomposition crystal and molecular properties the contents and format reflect the fact that theory experiment and computation are closely linked in this field since chemical decomposition is of fundamental importance in energetic performance this volume begins with a survey of the decomposition processes of a variety of energetic compounds this is followed by detailed studies of certain compounds and specific mechanisms such as nitro aci nitro tautomerism chapter 6 covers the transition from decomposition to crystal properties with molecular dynamics being the primary analytical tool the next several chapters deal with different aspects of the crystalline state again moving from the general to particular there is also a discussion of methods for computing gas liquid and solid phase heats of formation finally the last portion of this volume looks at the potential of high nitrogen molecules as energetic systems this has been of considerable interest in recent years overall this volume illustrates the progress that has been made in the field of energetic materials and some of the areas of current activity it also indicates the challenges involved in characterizing and understanding the properties and behaviour of these compounds the work is a unique state of the art treatment of the subject written by pre eminent researchers in the field overall emphasis is on theory and computation presented in the context of relevant experimental work presents a unique state of the art treatment of the subject contributors are pre eminent researchers in the field the mrs symposium proceeding series is an internationally recognised reference suitable for researchers and practitioners this book uses experimental and computational methods to rationalize and predict for the first time the relative impact sensitivities of a range of energetic materials using knowledge of crystal structures vibrational properties energy transfer mechanisms and experimentally measured sensitivities it describes a model that leads to excellent correlation with experimental results in all cases as such the book paves the way for a new fully ab initio approach for the design of safer energetic materials based solely on knowledge of their solid state structures energetic materials explosives propellants gas generators and pyrotechnics are defined as materials that release heat and or gaseous products at a high rate upon stimulus by heat impact shock sparks etc they have widespread military and civilian uses including munitions mining quarrying demolition emergency signaling automotive safety and space exploration one of their most important properties is sensitivity to accidental initiation during manufacture transport storage and operation which has important implications for their safe use this book discusses methods for the assessment of energetic compounds through heat of detonation detonation pressure velocity and temperature gurney energy and power the authors focus on the detonation pressure and detonation velocity of non ideal aluminized energetic compounds this 2nd edition includes an updated and improved presentation of simple reliable methods for the design synthesis and development of novel energetic compounds primarily driven by advancing technology and concerns for safety advancement in the world of pyrotechnics and high energy materials has

exploded in the past 25 years the promulgation of new government regulations places new and more stringent restrictions on the materials that may be used in energetic mixtures these regulations now mandate numerous training programs and initiate other actions such as osha s process safety management standard intended to eliminate accidents and incidents unfortunately the us lacks an organized broad range academic program to cover the science and use of energetic materials and educate the next generation of pyrotechnicians designed as a bridge to allow a smooth and confident transition for personnel coming from a chemistry background into the practical world of explosives chemistry of pyrotechnics basic principles and theory second edition emphasizes basic chemical principles alongside practical hands on knowledge in the preparation of energetic mixtures it examines the interactions between and adaptations of pyrotechnics to changing technology in areas such as obscuration science and low signature flame emission much more than a simple how to guide the book discusses chemical and pyrotechnic principles components of high energy mixtures and elements of ignition propagation and sensitivity it offers heat compositions including ignition mixes delays thermites and propellants and investigates the production of smoke and sound as well as light and color promoting the growth and expansion of pyrotechnics as a science chemistry of pyrotechnics basic principles and theory second edition provides practitioners with the ability to apply chemical principles and logic to energetic materials and thereby make the field as productive useful and safe as possible this book summarizes science and technology of a new generation of high energy and insensitive explosives the objective is to provide professionals with comprehensive information on the synthesis and the physicochemical and detonation properties of the explosives potential technologies applicable for treatment of contaminated wastestreams from manufacturing facilities and environmental matrices are also included this book provides the reader an insight into the depth and breadth of theoretical and empirical models and experimental techniques currently being developed in the field of energetic materials it presents the latest research by doD engineers and scientists and some of doD s academic and industrial researcher partners the topics explored and the simulations developed or modified for the purposes of energetics may find application in other closely related fields such as the pharmaceutical industry one of the key features of the book is the treatment of wastewaters generated during manufacturing of these energetic materials this up to date overview provides the latest information on the performance sensitivity strength and processability aspects of propellants and explosive formulations with the nature of polymer binder plasticizer as the variable factor apart from applications this monograph explores the principles behind energetic polymers while discussing the synthetic routes and energetic characteristics of individual family of energetic polymers furthermore a number of case studies illustrate the role of energetic polymers on enhancing the performance of formulations as compared to their inert counterparts the emphasis is on safety throughout with practical guidance on how to safely handle and formulate energetic polymer based formulations with the advent of a new generation of energetic polymers this book is relevant to industry and defense organizations as well as for academic research the book contains ten chapters chapter 1 deals with classification of propellants and explosives mechanism of thermal decomposition of ammonium perchlorate ap has been given in chapter 2 synthesis and characterization of various types of nanomaterials such as oxides ferrites cobaltites oxalates mono bi and tri metals of transition metals and oxides of lanthanides have been discussed in chapter 3 these have been found to be potential thermal decomposition and burning rate catalysts for ap and composite solid propellants the preparative methods for various types of nanoenergetic compounds have been described in chapter 4 thermolysis of various types of nitrate perchlorate and nitrate salts has been discussed in chapters 5 7 preparation and characterization of transition lanthanoids metal nitrate and perchlorate complexes with ligand of various amines have been described in chapters 8 10 in each group of compounds the structural properties of the individual compounds are determined by gravimetric ir and nmr studies for those compounds which gave crystals x ray crystallography technique was undertaken to determine their structures the results obtained from thermoanalytical and kinetic investigations related to the thermal decomposition ignition explosion and combustion of the compounds have also been described the author hopes this book will be of interest to everyone involved with energetic materials irrespective of their background this will prove useful to the serious college students as a text to the engineers interested in the broad aspects of aerospace and as an introduction to the propulsion of missiles or space vehicles this book will be helpful to the people working in r d laboratories universities institutes production agencies forensic laboratories armed forces army navy and air force quality assurance homeland securities chemical industries etc this book will be of immense use to organizations dealing with the production of commercial explosives and allied chemicals it is hoped that this compilation of work will serve to stimulate more interest and promote further progress in the research into the properties and applications of these family of compounds reported in this book organic chemistry of explosives is the first text to bring together the

essential methods and routes used for the synthesis of organic explosives in a single volume assuming no prior knowledge the book discusses everything from the simplest mixed acid nitration of toluene to the complex synthesis of highly energetic caged nitro compounds reviews laboratory and industrial methods which can be used to introduce aliphatic c nitro aromatic c nitro n nitro and nitrate ester functionality into organic compounds discusses the advantages and disadvantages of each synthetic method or route with scope limitations substrate compatibility and other important considerations features numerous examples in the form of text reaction diagrams and tables energetic nanomaterials synthesis characterization and application provides researchers in academia and industry the most novel and meaningful knowledge on nanoenergetic materials covering the fundamental chemical aspects from synthesis to application this valuable resource fills the current gap in book publications on nanoenergetics the energetic nanomaterials that are applied in explosives gun and rocket propellants and pyrotechnic devices which are expected to yield improved properties such as a lower vulnerability towards shock initiation enhanced blast and environmentally friendly replacements of currently used materials the current lack of a systematic and easily available book in this field has resulted in an underestimation of the input of nanoenergetic materials to modern technologies this book is an indispensable resource for researchers in academia industry and research institutes dealing with the production and characterization of energetic materials all over the world written by high level experts in the field of nanoenergetics covers the hot topic of energetic nanomaterials including nanometals and their applications in nanoexplosives fills a gap in energetic nanomaterials book publications nitrogen rich energetic materials provides in depth and comprehensive knowledge on both the chemistry and practical applications of nitrogen rich energetic materials energetic materials a class of material with high amounts of stored chemical energy include explosives pyrotechnics and propellants initially used for military applications nitrogen rich energetic materials have become important in the civil engineering and aerospace sectors they are increasingly used in commercial mining and construction as well as in rocket propulsion making these nitrogen rich energetic materials safer more powerful and more cost effective requires a thorough understanding of their chemistry physics synthesis properties and applications nitrogen rich energetic materials presents a detailed summary of the development of nitrogen rich energetic materials over the past decade and provides up to date knowledge on their applications in various areas of advanced engineering edited by a panel of international experts in the field this book examines the chemistry of pentazoles fused ring and laser ignitable nitrogen rich compounds polynitrogen and tetrazole based energetic compounds and more the text also introduces applications of nitrogen rich energetic materials in energetic polymers and metal organic frameworks as pyrotechnics materials for light and smoke and in oxadiazoles from precursor molecules this authoritative volume presents in depth chapters written by leading experts in each sub field covered offers a systematic introduction to new and emerging applications of nitrogen rich energetic materials such as in computational chemistry discusses recent advances in nitrate ester chemistry with focus on propellant applications discusses green and eco friendly approaches to nitrogen rich compounds nitrogen rich energetic materials is an important resource for researchers academics and industry professionals across fields including explosives specialists pyrotechnicians materials scientists polymer chemists laser specialists physical chemists environmental chemists chemical engineers and safety officers

High Energy Materials 2015-11-20 authored by an insider with over 40 years of high energy materials hems experience in academia industry and defense organizations this handbook and ready reference covers all important hems from the 1950s to the present with their respective properties and intended purposes written at an attainable level for professionals engineers and technicians alike the book provides a comprehensive view of the current status and suggests further directions for research and development an introductory chapter on the chemical and thermodynamic basics allows the reader to become acquainted with the fundamental features of explosives before moving on to the important safety aspects in processing handling transportation and storage of high energy materials with its collation of results and formulation strategies hitherto scattered in the literature this should be on the shelf of every hem researcher and developer

High Energy Materials 2010-04-05 hier meldet sich ein wahrer insider zu wort Über 40 jahre erfahrung aus der industriellen und akademischen forschung und der arbeit für verteidigungsorganisationen kondensiert der autor in diesem leitfaden der spreng und explosivstoffe

Chemistry of High-Energy Materials 2017-08-21 the 4th revised edition expands on the basic chemistry of high energy materials of the precious editions and examines new research developments including hydrodynamics and ionic liquids applications in military and civil fields are discussed this work is of interest to advanced students in chemistry materials science and engineering as well as to all those working in defense technology

Nano and Micro-Scale Energetic Materials, 2 Volumes 2023-01-24 provides an up to date account of innovative energetic materials and their potential applications in space propulsion and high explosives most explosives and propellants currently use a small number of ingredients such as tnt and nitrocellulose in comparison to conventional materials nano and micro scale energetic materials exhibit superior burning characteristics and much higher energy densities and explosive yields nano and micro scale energetic materials propellants and explosives provides a timely overview of innovative nano scale energetic materials nems and microscale energetic materials μ ems technology covering nems and μ ems ingredients as well as formulations this comprehensive volume examines the preparation characterization ignition combustion and performance of energetic materials in various applications of propellants and explosives twenty two chapters explore metal based pyrotechnic nanocomposites solid and hybrid rocket propulsion solid fuels for in space and power the sensitivity and mechanical properties of explosives new energetic materials and more explores novel energetic materials and their potential for use in propellants and explosives summarizes the most recent advances of leading research groups currently active in twelve countries discusses how new environmentally friendly high combustion energetic materials can best be used in different applications explains the fundamentals of energetic materials including similarities and differences between composite propellants and explosives nano and micro scale energetic materials propellants and explosives is an important resource for materials scientists explosives specialists pyrotechnicians environmental chemists polymer chemists physical chemists aerospace physicians and aerospace engineers working in both academia and industry

Combustion of Energetic Materials 2002 this edited book contains state of the art information associated with energetic material combustion there are twelve topical areas including reaction kinetics of energetic materials solid liquid and gel propellants recycling of energetic materials combustion performance of hybrid and solid rocket motors ignition and combustion of energetic materials energetic material defects and rocket engine flowfields metal combustion pyrolysis and combustion processes of new ingredients and applications theoretical modeling and numerical simulation of combustion processes of energetic materials combustion diagnostic techniques propellant and rocket motor stability commercial applications of energetic materials airbags gas generators etc and thermal insulation and ablation processes

Demystifying Explosives 2015-01-09 demystifying explosives concepts in high energy materials explains the basic concepts of and the science behind the entire spectrum of high energy materials hems and gives a broad perspective about all types of hems and their interrelationships demystifying explosives covers topics ranging from explosives deflagration detonation and pyrotechnics to safety and security aspects of hems looking at their aspects particularly their inter relatedness with respect to properties and performance the book explains concepts related to the molecular structure of hems their properties performance parameters detonation and shock waves including explosives and propellants the theory based title also deals with important safety and security and interesting constructive applications aspects connected with hems and is of fundamental use to students in their introduction to these materials and applications explains the concept of high energy materials in simple language and down to earth examples worked examples and problems are given wherever required demystifies the concept of explosives limited use of big and complex equations questions and suggested reading are given at

the end of each chapter

Nano and Micro-Scale Energetic Materials 2023-01-26 provides an up to date account of innovative energetic materials and their potential applications in space propulsion and high explosives most explosives and propellants currently use a small number of ingredients such as tnt and nitrocellulose in comparison to conventional materials nano and micro scale energetic materials exhibit superior burning characteristics and much higher energy densities and explosive yields nano and micro scale energetic materials propellants and explosives provides a timely overview of innovative nano scale energetic materials nems and microscale energetic materials μ ems technology covering nems and μ ems ingredients as well as formulations this comprehensive volume examines the preparation characterization ignition combustion and performance of energetic materials in various applications of propellants and explosives twenty two chapters explore metal based pyrotechnic nanocomposites solid and hybrid rocket propulsion solid fuels for in space and power the sensitivity and mechanical properties of explosives new energetic materials and more explores novel energetic materials and their potential for use in propellants and explosives summarizes the most recent advances of leading research groups currently active in twelve countries discusses how new environmentally friendly high combustion energetic materials can best be used in different applications explains the fundamentals of energetic materials including similarities and differences between composite propellants and explosives nano and micro scale energetic materials propellants and explosives is an important resource for materials scientists explosives specialists pyrotechnicians environmental chemists polymer chemists physical chemists aerospace physicians and aerospace engineers working in both academia and industry

Innovative Energetic Materials: Properties, Combustion Performance and Application 2020-07-04 this book focuses on the combustion performance and application of innovative energetic materials for solid and hybrid space rocket propulsion it provides a comprehensive overview of advanced technologies in the field of innovative energetic materials and combustion performance introduces methods of modeling and diagnosing the aggregation agglomeration of active energetic metal materials in solid propellants and investigates the potential applications of innovative energetic materials in solid and hybrid propulsion in addition it also provides step by step solutions for sample problems to help readers gain a good understanding of combustion performance and potential applications of innovative energetic materials in space propulsion this book serves as an excellent resource for researchers and engineers in the field of propellants explosives and pyrotechnics

Fast Reactions in Energetic Materials 2008-09-26 modern energetic materials include explosives blasting powders pyrotechnic mixtures and rocket propellants 1 2 the study of high temperature decomposition of condensed phases of propellants and their components liquid solid and hybrid is currently of special importance for the development of space system engineering 3 4 to better understand the burning mechanisms stationary nonstationary steady of composite solid propellants and their components information about the macrokinetics of their high temperature decomposition is required 5 to be able to evaluate the ignition parameters and conditions of safe handling of heat affected explosives one needs to know the kinetic constants of their high temperature composition the development of new composite solid propellants characterized by high performance characteristics high burning rates high thermal stability stability to intrachamber perturbations and other aspects is not possible without quantitative data on the high temperature decomposition of composite solid propellants and their components 6 the same reasons have resulted in significant theoretical and practical interest in the high temperature decomposition of components of hybrid propellants it is known that hybrid propellants have not been used very widely due to the low burning pyrolysis rates of the polymer blocks in the combustion chambers of hybrid rocket engines to increase the burning rates it is necessary to obtain information about their relationships to the corresponding kinetic and thermophysical properties of the fuels

Energetic Materials 2003-11-21 this volume provides an overview of current research and recent advances in the area of energetic materials focusing on explosives and propellants the contents and format reflect the fact that theory experiment and computation are closely linked in this field the challenge of developing energetic materials that are less sensitive to accidental stimuli continues to be of critical importance this volume opens with discussions of some determinants of sensitivity and its correlations with various molecular and crystal properties the next several chapters deal in considerable detail with different aspects and mechanisms of the initiation of detonation and its quantitative description the second half of this volume focuses upon combustion extensive studies model ignition and combustion with applications to different propellants the final chapter is an exhaustive computational treatment of the mechanism and kinetics of combustion initiation reactions of ammonium perchlorate overall this volume illustrates the progress that has been made in the

field of energetic materials and some of the areas of current activity it also indicates the challenges involved in characterizing and understanding the properties and behaviour of these compounds the work is a unique state of the art treatment of the subject written by pre eminent researchers in the field overall emphasis is on theory and computation presented in the context of relevant experimental work presents a unique state of the art treatment of the subject contributors are preeminent researchers in the field

Energetic Materials 2006-03-06 incorporation of particular components with specialized properties allows one to tailor the end product s properties for instance the sensitivity burning behavior thermal or mechanical properties or stability of energetic materials can be affected and even controllably varied through incorporation of such ingredients this book examines particle technologies as applied to energetic materials such as propellants and explosives thus filling a void in the literature on this subject following an introduction covering general features of energetic materials the first section of this book describes methods of manufacturing particulate energetic materials including size reduction crystallization atomization particle formation using supercritical fluids and microencapsulation agglomeration phenomena special considerations in mixing explosive particles and the production of nanoparticles the second section discusses the characterization of particulate materials techniques and methods such as particle size analysis morphology elucidation and the determination of chemical and thermal properties are presented the wettability of powders and rheological behavior of suspensions and solids are also considered furthermore methods of determining the performance of particular energetic materials are described each chapter deals with fundamentals and application possibilities of the various methods presented with particular emphasis on issues applicable to particulate energetic materials the book is thus equally relevant for chemists physicists material scientists chemical and mechanical engineers and anyone interested or engaged in particle processing and characterization technologies

Green Energetic Materials 2014-01-15 this comprehensive book presents a detailed account of research and recent developments in the field of green energetic materials including pyrotechnics explosives and propellants this area is attracting increasing interest in the community as it undergoes a transition from using traditional processes to more environmentally friendly procedures the book covers the entire line of research from the initial theoretical modelling and design of new materials to the development of sustainable manufacturing processes it also addresses materials that have already reached the production line as well as considering future developments in this evolving field

Propellants and Explosives 2015-04-23 this third edition of the classic on the thermochemical aspects of the combustion of propellants and explosives is completely revised and updated and now includes a section on green propellants and offers an up to date view of the thermochemical aspects of combustion and corresponding applications clearly structured the first half of the book presents an introduction to pyrodynamics describing fundamental aspects of the combustion of energetic materials while the second part highlights applications of energetic materials such as propellants explosives and pyrolants with a focus on the phenomena occurring in rocket motors finally an appendix gives a brief overview of the fundamentals of aerodynamics and heat transfer which is a prerequisite for the study of pyrodynamics a detailed reference for readers interested in rocketry or explosives technology

Advanced Energetic Materials 2004-01-30 advanced energetic materialsâ explosive fill and propellantsâ are a critical technology for national security while several new promising concepts and formulations have emerged in recent years the department of defense is concerned about the nation s ability to maintain and improve the knowledge base in this area to assist in addressing these concerns two offices within dod asked the nrc to investigate and assess the scope and health of the u s r d efforts in energetic materials this report provides that assessment it presents several findings about the current r d effort and recommendations aimed at improving u s capabilities in developing new energetic materials technology this study reviewed u s research and development in advanced energetics being conducted by dod the doe national laboratories industries and academia from a list provided by the sponsors it also a reviewed papers and technology assessments of non u s work in advanced energetics assessed important parameters such as validity viability and the likelihood that each of these materials can be produced in quantity b identified barriers to scale up and production and suggested technical approaches for addressing potential problems and c suggested specific opportunities strategies and priorities for government sponsorship of technologies and manufacturing process development

Energetic Materials 2017-10-09 this book offers a comprehensive account of energetic materials including their synthesis computational modeling applications associated degradation mechanisms environmental consequences and fate and transport this multi author contributed volume describes how

armed forces around the world are moving their attention from legacy explosive compounds which are heat and shock sensitive thus posing greater challenges in terms of handling and storage to the insensitive munitions compounds formulations such as insensitive munitions explosive imx and the picatinny arsenal explosive pax series of compounds the description of energetic materials focuses on explosives pyrotechnic compositions and propellants the contributors go on to explain how modern generation energetic compounds must be insensitive to shock and heat but at the same time yield more energy upon explosion nanoinspired and or co crystallized energetic materials offer another route to generate next generation energetic materials and this authoritative book bridges a large gap in the literature by providing a comprehensive analysis of these compounds additionally it includes a valuable overview of energetic materials a detailed discussion of recent advances on future energetic compounds nanotechnology in energetic materials environmental contamination and toxicity assessment of munitions lethality the application quantitative structure activity relationship qsar in design of energetics and the fate and transport of munition compounds in the environment

Energetic Materials Research, Applications, and New Technologies 2017-12-29 in the last decade there has been an influx in the development of new technologies for deep space exploration countries all around the world are investing in resources to create advanced energetic materials and propulsion systems for their aerospace initiatives energetic materials research applications and new technologies is an essential reference source of the latest research in aerospace engineering and its application in space exploration featuring comprehensive coverage across a range of related topics such as molecular dynamics rocket engine models propellants and explosives and quantum chemistry calculations this book is an ideal reference source for academicians researchers advanced level students and technology developers seeking innovative research in aerospace engineering

Chemistry and Physics of Energetic Materials 2012-12-06 this book represents a collection of lectures presented at the nato advanced study institute asi on chemistry physics of the molecular processes in energetic materials held at hotel torre normanna altavilla milicia sicily italy september 3 to 15 1989 the institute was attended by seventy participants including twenty lecturers drawn from thirteen countries the purpose of the institute was to review the major advances made in recent years in the theoretical and experimental aspects of explosives and propellants in accordance with the format of the nato asi it was arranged to have a relatively small number of speakers to present in depth review type lectures emphasizing the basic research aspects of the subject over a two week period most of the speakers gave two lectures each in excess of one hour with additional time for discussions the scope of the meeting was limited to molecular and spectroscopic studies since the hydrodynamic aspects of detonation and various performance criteria of energetic materials are often covered adequately in other international meetings an attempt was made to have a coherent presentation of various theoretical computational and spectroscopic approaches to help a better understanding of energetic materials from a molecular point of view the progress already made in these areas is such that structure property e g

Metal-Fluorocarbon Based Energetic Materials 2012-03-26 metal fluorocarbon based energetic materials this exciting new book details all aspects of a major class of pyrolants and elucidates the progress that has been made in the field covering both the chemistry and applications of these compounds written by a pre eminent authority on the subject from the nato munitions safety information analysis center msiac it begins with a historical overview of the development of these materials followed by a thorough discussion of their ignition combustion and radiative properties the next section explores the multiple facets of their military and civilian applications as well as industrial synthetic techniques the critical importance of the associated hazards namely sensitivity stability and aging are discussed in detail and the book is rounded off by an examination of the future of this vital and expanding field the result is a complete guide to the chemistry manufacture applications and required safety precautions of pyrolants for both the military and chemical industries from the preface this book fills a void in the collection of pyrotechnic literature it will make an excellent reference book that all researchers of pyrolants and energetics must have dr bernard e doula dr sara pliskin navsea crane in usa

High Energy Intensive Materials (Propellants, Explosives and Pyrotechnics). Part I. Explosives 2017-09-05 В основе учебного пособия лежит идея взаимосвязанного и одновременного развития профессиональных и коммуникативных языковых компетенций необходимых в профессиональном общении будущих специалистов в области высокоэнергетических материалов Цель пособия подвести студентов к чтению оригинальной литературы по специальности и ведению беседы на темы предусмотренные программой языковой подготовки третьего поколения Energetic Materials 2003 the study of energetic materials is emerging from one primarily directed toward practical interests to an advanced area of

fundamental research where state of the art methods and theory are used side by side with modern synthetic methods this timely book integrates the recent experimental synthetic and theoretical research of energetic materials editors george olah and david squire emphasize the importance of structure and mechanism in determining properties and performances they also explore new spectrometric methods and synthetic approaches in this useful reference discusses structural analysis by x ray crystallography explains chemical dynamics by photofragmentation translational spectroscopy covers kinetic analysis by ultrafast absorption and emission spectroscopy details syntheses of polycyclic caged amines fuel additives and polynitro compounds examines computer aided design of monopropellants includes contributions by two nobel laureates and five members of the national academy of sciences

Chemistry of Energetic Materials 2012-12-02 developed and expanded from the work presented at the new energetic materials and propulsion techniques for space exploration workshop in june 2014 this book contains new scientific results up to date reviews and inspiring perspectives in a number of areas related to the energetic aspects of chemical rocket propulsion this collection covers the entire life of energetic materials from their conceptual formulation to practical manufacturing it includes coverage of theoretical and experimental ballistics performance properties as well as laboratory scale and full system scale handling hazards environment ageing and disposal chemical rocket propulsion is a unique work where a selection of accomplished experts from the pioneering era of space propulsion and current technologists from the most advanced international laboratories discuss the future of chemical rocket propulsion for access to and exploration of space it will be of interest to both postgraduate and final year undergraduate students in aerospace engineering and practicing aeronautical engineers and designers especially those with an interest in propulsion as well as researchers in energetic materials

Chemical Rocket Propulsion 2016-08-19 the book is a treatise on solid propellants in nine chapters covering the history chemistry energetics processing and characterization aspects of composite solid propellants internal ballistics advanced solid propellants safety quality and reliability and homogenous or double base propellants the book also traces the evolution of solid propellant technology in isro for launch vehicles and sounding rockets there is a detailed table of contents expanded index glossary exhaustive references and questions in each chapter it can be used as a textbook for science and engineering students as a reference book for researchers and as a companion to scientists and engineers working in the research development and production areas of solid propellants

The Chemistry and Technology of Solid Rocket Propellants (A Treatise on Solid Propellants) 2017-03-29 this dictionary contains 739 entries with about 1400 references to the primary literature details on the composition performance sensitivity and other pertinent properties of energetic materials such as high explosives propellants pyrotechnics as well as important ingredients such as oxidizers fuels binders and modifiers are given and presented partly in over 180 tables with more than 240 structural formulas in detail the dictionary gives elaborate descriptions of 460 chemical substances 170 pyrotechnic compositions 360 high explosive and propellant formulations in addition the basic physical and thermochemical properties of 435 pure substances elements compounds typically occurring as ingredients or reaction products are given too 150 figures schemes and diagrams explain applications test methods scientific facilities and finally individuals closely tied with the development and investigation of energetic materials the book is intended for readers with a technical or scientific background active in governmental agencies research institutes trade and industry concerned with the procurement development manufacture investigation and use of energetic materials such as high explosives propellants pyrotechnics fireworks and ammunition the book serves both as a daily reference for the experienced as well as an introduction for the newcomer to the field

Propellants, Explosives, Rockets and Guns 1998 few books cover experimental and theoretical methods to characterize decomposition combustion and detonation of energetic materials this volume by internationally known and major contributors to the field is unique because it summarizes the most important recent work what we know with confidence and what main areas remain to be investigated most chapters comprise summaries of work spanning decades and contain expert commentary available nowhere else although energetic materials are its focus this book provides a guide to modern methods for investigations of condensed and gas phase reactions although these energetic reactions are complex and difficult to study the work discussed here provides readers with a substantial understanding of the behavior of materials now in use and a predictive capability for the development of new materials based on target properties contents connecting molecular properties to decomposition combustion and explosion trends t b brill thermal decomposition processes of energetic materials in the condensed phase at low and moderate temperatures r behrens study of energetic material combustion chemistry by

probing mass spectrometry and modeling of flames o p korobeinichev optical spectroscopic measurements of energetic material flame structure t parr d hanson parr transient gas phase intermediates in the decomposition of energetic materials p j dagdigian role of excited electronic states in the decomposition of energetic materials e r bernstein gas phase kinetics for propellant combustion modeling requirements and experiments w r anderson a fontijn gas phase decomposition of energetic molecules d l thompson modeling the reactions of energetic materials in the condensed phase l e fried et al multi phonon up pumping in energetic materials d d dlott applications of theoretical chemistry in assessing energetic materials for performance or sensitivity b m rice combustion and ignition of nitramine propellants aspects of modeling simulation and analysis e s kim v yang burning rate models and their successors a personal perspective m s miller ideas to expand thinking about new energetic materials j bottaro readership researchers studying fast chemical reactions and materials behavior under extreme conditions experts and beginners in energetic decomposition combustion and detonation research keywords energetic materials combustion thermal decomposition combustion model materials design flames explosive propellant computational chemistry detonationkey features summarizes the known knowns the most important recent work and lists the known unknowns what remains to be investigated provides expert commentary on the complex behavior of materialsreviews this book nicely covers the application of many experimental and theoretical tools to study the difficult problem of ignition and combustion of many traditional energetic materials it could be a valuable resource to the researchers in the field journal of the american chemical society

High Explosives, Propellants, Pyrotechnics 2021-01-18 this unique book investigates the synthesis kinetics and thermal decomposition properties and processing of energy producing materials used in propellants explosives pyrotechnic and gas generating compositions thermal decomposition and combustion of explosives and propellants provides several mechanisms and stages for the thermal decomposition and combustion reactions of most flammable compounds and their mixtures such as aliphatic and aromatic nitrocompounds nitramines nitroesters organic azides furazanes tetrazols difluoroamines polynitrous heterocycles and onium salts the authors examine the classic problem of the dependence of explosive activity on molecular structure using applications to predict the stability compatibility and the stabilization of explosives and propellant components they also offer experimental results examining factors such as subsurface decomposition evaporation and dispersion of materials which can be used to control combustion of condensed systems providing several approaches to stability safety and controlled combustion of flammable substances thermal decomposition and combustion of explosives and propellants is a multi dimensional resource for graduate students researchers and professionals interested in chemical kinetics the combustion and synthesis of high energy materials criminal forensics and the field of explosives powders and solid rocket propellants

Overviews of Recent Research on Energetic Materials 2005-08-02 the energetic materials encyclopedia is a compendium of pure energetic materials i e not formulations which summarizes the most important parameters of these compounds the impact friction and electrostatic discharge esd sensitivity parameters are reported thermal parameters such as the melting points and decomposition temperatures are also given together with the thermodynamic enthalpies of formation the density values that govern the detonation performance are given for the theoretical maximum density tmd and where appropriate also for lower densities the most important performance parameters such as the detonation pressure the detonation velocity as well as the temperature of explosion and the heat of explosion are also stated wherever possible experimental values are given together with calculated parameters if multiple values for one property were available from the literature these are also stated e g 20 different detonation velocities for rdx for all literature values the original references have been included the energetic materials encyclopedia will be of interest for advanced students of chemistry materials science engineering and professionals in military technology

Thermal Decomposition and Combustion of Explosives and Propellants 2003-01-30 this volume provides an overview of current research and recent advances in the area of energetic materials focusing on decomposition crystal and molecular properties the contents and format reflect the fact that theory experiment and computation are closely linked in this field since chemical decomposition is of fundamental importance in energetic performance this volume begins with a survey of the decomposition processes of a variety of energetic compounds this is followed by detailed studies of certain compounds and specific mechanisms such as nitro aci nitro tautomerism chapter 6 covers the transition from decomposition to crystal properties with molecular dynamics being the primary analytical tool the next several chapters deal with different aspects of the crystalline state again moving from the general to particular there is also a discussion of methods for computing gas liquid and solid phase heats of formation finally the last portion of this volume

looks at the potential of high nitrogen molecules as energetic systems this has been of considerable interest in recent years overall this volume illustrates the progress that has been made in the field of energetic materials and some of the areas of current activity it also indicates the challenges involved in characterizing and understanding the properties and behaviour of these compounds the work is a unique state of the art treatment of the subject written by pre eminent researchers in the field overall emphasis is on theory and computation presented in the context of relevant experimental work presents a unique state of the art treatment of the subject contributors are preeminent researchers in the field

Energetic Materials Encyclopedia 2018 the mrs symposium proceeding series is an internationally recognised reference suitable for researchers and practitioners

Energetic Materials 2003-11-25 this book uses experimental and computational methods to rationalize and predict for the first time the relative impact sensitivities of a range of energetic materials using knowledge of crystal structures vibrational properties energy transfer mechanisms and experimentally measured sensitivities it describes a model that leads to excellent correlation with experimental results in all cases as such the book paves the way for a new fully ab initio approach for the design of safer energetic materials based solely on knowledge of their solid state structures energetic materials explosives propellants gas generators and pyrotechnics are defined as materials that release heat and or gaseous products at a high rate upon stimulus by heat impact shock sparks etc they have widespread military and civilian uses including munitions mining quarrying demolition emergency signaling automotive safety and space exploration one of their most important properties is sensitivity to accidental initiation during manufacture transport storage and operation which has important implications for their safe use

Structure and Properties of Energetic Materials: Volume 296 1993-05-28 this book discusses methods for the assessment of energetic compounds through heat of detonation detonation pressure velocity and temperature gurney energy and power the authors focus on the detonation pressure and detonation velocity of non ideal aluminized energetic compounds this 2nd edition includes an updated and improved presentation of simple reliable methods for the design synthesis and development of novel energetic compounds

Mechanochemical Processes in Energetic Materials 2020-11-23 primarily driven by advancing technology and concerns for safety advancement in the world of pyrotechnics and high energy materials has exploded in the past 25 years the promulgation of new government regulations places new and more stringent restrictions on the materials that may be used in energetic mixtures these regulations now mandate numerous training programs and initiate other actions such as osha s process safety management standard intended to eliminate accidents and incidents unfortunately the us lacks an organized broad range academic program to cover the science and use of energetic materials and educate the next generation of pyrotechnicians designed as a bridge to allow a smooth and confident transition for personnel coming from a chemistry background into the practical world of explosives chemistry of pyrotechnics basic principles and theory second edition emphasizes basic chemical principles alongside practical hands on knowledge in the preparation of energetic mixtures it examines the interactions between and adaptations of pyrotechnics to changing technology in areas such as obscuration science and low signature flame emission much more than a simple how to guide the book discusses chemical and pyrotechnic principles components of high energy mixtures and elements of ignition propagation and sensitivity it offers heat compositions including ignition mixes delays thermites and propellants and investigates the production of smoke and sound as well as light and color promoting the growth and expansion of pyrotechnics as a science chemistry of pyrotechnics basic principles and theory second edition provides practitioners with the ability to apply chemical principles and logic to energetic materials and thereby make the field as productive useful and safe as possible

Energetic Compounds 2020-05-05 this book summarizes science and technology of a new generation of high energy and insensitive explosives the objective is to provide professionals with comprehensive information on the synthesis and the physicochemical and detonation properties of the explosives potential technologies applicable for treatment of contaminated wastestreams from manufacturing facilities and environmental matrices are also included this book provides the reader an insight into the depth and breadth of theoretical and empirical models and experimental techniques currently being developed in the field of energetic materials it presents the latest research by doD engineers and scientists and some of doD s academic and industrial researcher partners the topics explored and the simulations developed or modified for the purposes of energetics may find application in other closely related fields such as the pharmaceutical industry one of the key features of the book is the treatment of wastewaters generated during manufacturing of

these energetic materials

Chemistry of Pyrotechnics 2010-12-23 this up to date overview provides the latest information on the performance sensitivity strength and processability aspects of propellants and explosive formulations with the nature of polymer binder plasticizer as the variable factor apart from applications this monograph explores the principles behind energetic polymers while discussing the synthetic routes and energetic characteristics of individual family of energetic polymers furthermore a number of case studies illustrate the role of energetic polymers on enhancing the performance of formulations as compared to their inert counterparts the emphasis is on safety throughout with practical guidance on how to safely handle and formulate energetic polymer based formulations with the advent of a new generation of energetic polymers this book is relevant to industry and defense organizations as well as for academic research

Emerging Energetic Materials: Synthesis, Physicochemical, and Detonation Properties 2018-01-02 the book contains ten chapters chapter 1 deals with classification of propellants and explosives mechanism of thermal decomposition of ammonium perchlorate has been given in chapter 2 synthesis and characterization of various types of nanomaterials such as oxides ferrites cobaltites oxalates mono bi and tri metals of transition metals and oxides of lanthanides have been discussed in chapter 3 these have been found to be potential thermal decomposition and burning rate catalysts for ap and composite solid propellants the preparative methods for various types of nanoenergetic compounds have been described in chapter 4 thermolysis of various types of nitrate perchlorate and nitrate salts has been discussed in chapters 5 7 preparation and characterization of transition lanthanoid metal nitrate and perchlorate complexes with ligand of various amines have been described in chapters 8 10 in each group of compounds the structural properties of the individual compounds are determined by gravimetric ir and nmr studies for those compounds which gave crystals x ray crystallography technique was undertaken to determine their structures the results obtained from thermoanalytical and kinetic investigations related to the thermal decomposition ignition explosion and combustion of the compounds have also been described the author hopes this book will be of interest to everyone involved with energetic materials irrespective of their background this will prove useful to the serious college students as a text to the engineers interested in the broad aspects of aerospace and as an introduction to the propulsion of missiles or space vehicles this book will be helpful to the people working in r d laboratories universities institutes production agencies forensic laboratories armed forces army navy and air force quality assurance homeland securities chemical industries etc this book will be of immense use to organizations dealing with the production of commercial explosives and allied chemicals it is hoped that this compilation of work will serve to stimulate more interest and promote further progress in the research into the properties and applications of these family of compounds reported in this book

Energetic Polymers 2012-03-26 organic chemistry of explosives is the first text to bring together the essential methods and routes used for the synthesis of organic explosives in a single volume assuming no prior knowledge the book discusses everything from the simplest mixed acid nitration of toluene to the complex synthesis of highly energetic caged nitro compounds reviews laboratory and industrial methods which can be used to introduce aliphatic c nitro aromatic c nitro n nitro and nitrate ester functionality into organic compounds discusses the advantages and disadvantages of each synthetic method or route with scope limitations substrate compatibility and other important considerations features numerous examples in the form of text reaction diagrams and tables

Recent Advances on Energetic Materials 2015 energetic nanomaterials synthesis characterization and application provides researchers in academia and industry the most novel and meaningful knowledge on nanoenergetic materials covering the fundamental chemical aspects from synthesis to application this valuable resource fills the current gap in book publications on nanoenergetics the energetic nanomaterials that are applied in explosives gun and rocket propellants and pyrotechnic devices which are expected to yield improved properties such as a lower vulnerability towards shock initiation enhanced blast and environmentally friendly replacements of currently used materials the current lack of a systematic and easily available book in this field has resulted in an underestimation of the input of nanoenergetic materials to modern technologies this book is an indispensable resource for researchers in academia industry and research institutes dealing with the production and characterization of energetic materials all over the world written by high level experts in the field of nanoenergetics covers the hot topic of energetic nanomaterials including nanometals and their applications in nanoexplosives fills a gap in energetic nanomaterials book publications

Theory and Practice of Energetic Materials 2005 nitrogen rich energetic materials provides in depth and comprehensive knowledge on both the chemistry and practical applications of nitrogen rich energetic materials energetic materials a class of material with high amounts of stored chemical energy include explosives pyrotechnics and propellants initially used for military applications nitrogen rich energetic materials have become important in the civil engineering and aerospace sectors they are increasingly used in commercial mining and construction as well as in rocket propulsion making these nitrogen rich energetic materials safer more powerful and more cost effective requires a thorough understanding of their chemistry physics synthesis properties and applications nitrogen rich energetic materials presents a detailed summary of the development of nitrogen rich energetic materials over the past decade and provides up to date knowledge on their applications in various areas of advanced engineering edited by a panel of international experts in the field this book examines the chemistry of pentazoles fused ring and laser ignitable nitrogen rich compounds polynitrogen and tetrazole based energetic compounds and more the text also introduces applications of nitrogen rich energetic materials in energetic polymers and metal organic frameworks as pyrotechnics materials for light and smoke and in oxadiazoles from precursor molecules this authoritative volume presents in depth chapters written by leading experts in each sub field covered offers a systematic introduction to new and emerging applications of nitrogen rich energetic materials such as in computational chemistry discusses recent advances in nitrate ester chemistry with focus on propellant applications discusses green and eco friendly approaches to nitrogen rich compounds nitrogen rich energetic materials is an important resource for researchers academics and industry professionals across fields including explosives specialists pyrotechnicians materials scientists polymer chemists laser specialists physical chemists environmental chemists chemical engineers and safety officers

Organic Chemistry of Explosives 2007-01-11

Energetic Nanomaterials 2016-01-21

Nitrogen-Rich Energetic Materials 2022-12-12

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