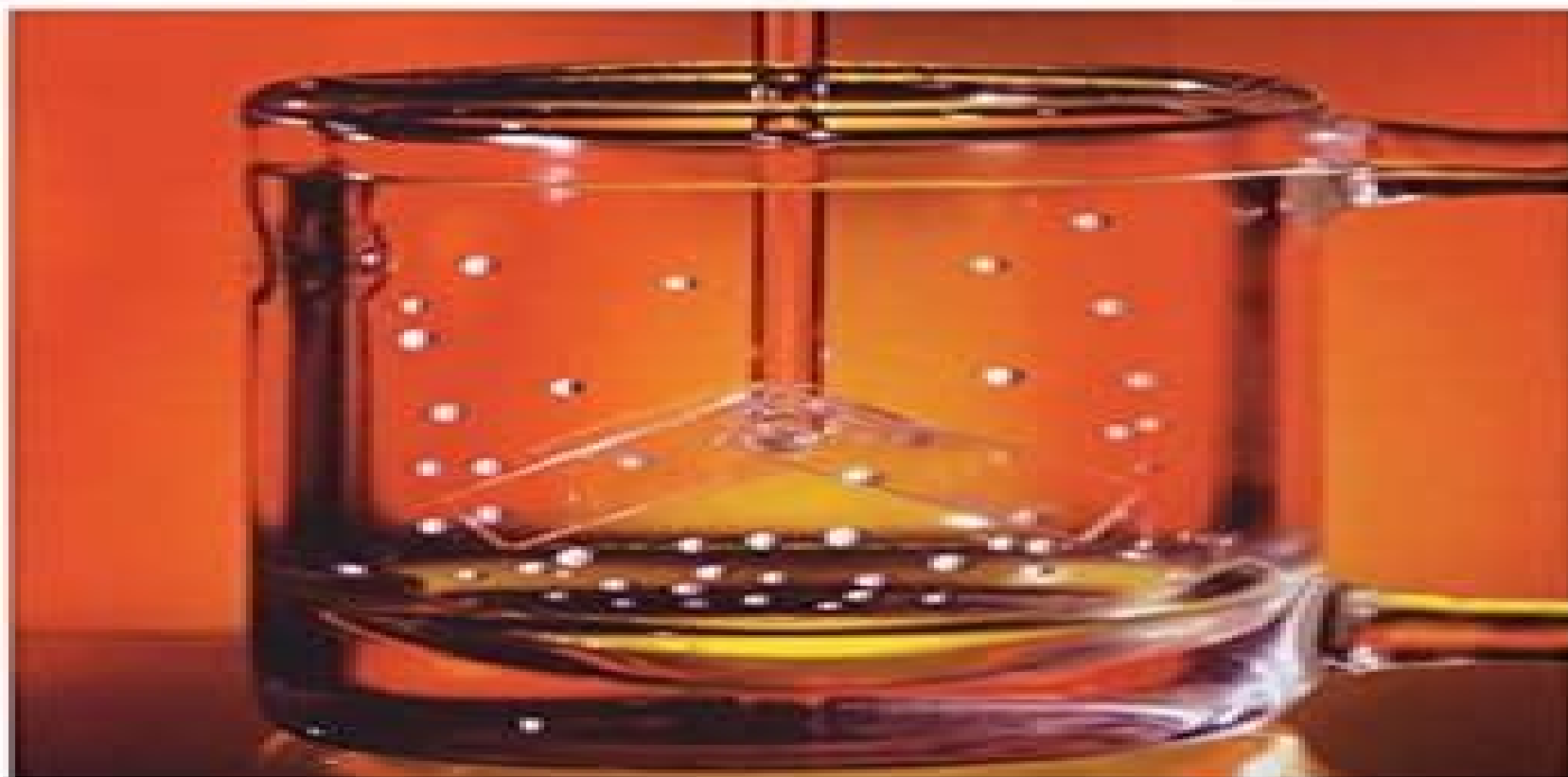


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Energetic Materials

Particle Processing and Characterization



Energetic Materials Particle Processing And Characterization

**Qi-Long Yan,Guo-Qiang He,Pei-Jin
Liu,Michael Gozin**



Energetic Materials Particle Processing And Characterization:

Energetic Materials Ulrich Teipel, 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. *Energetic materials* Ulrich Teipel, 1998 *Energetic Materials* Manoj K. Shukla, Veera M. Boddu, Jeffery A. Steevens, Reddy Damavarapu, Jerzy Leszczynski, 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 of quantitative structure-activity relationship (QSAR) in design of energetics, and the fate and transport of munition compounds in the environment. Nano-Energetic Materials Shantanu

Bhattacharya, Avinash Kumar Agarwal, T. Rajagopalan, Vinay K. Patel, 2018-11-09 This book presents the latest research on the area of nano energetic materials their synthesis fabrication patterning application and integration with various MEMS systems and platforms Keeping in mind the applications for this field in aerospace and defense sectors the articles in this volume contain contributions by leading researchers in the field who discuss the current challenges and future perspectives This volume will be of use to researchers working on various applications of high energy research *Intrinsic Structures and Properties of Energetic Materials* Chaoyang Zhang, Jing Huang, Rupeng Bu, 2023-06-30 This book highlights the intrinsic structures of all kinds of energetic compounds and some structure property relationships therein Energetic materials are a class of energy materials that can transiently release a large amount of gases and heat by self redox after stimulated and usually refer to explosives propellants and pyrotechnics Nowadays in combination with various theories and simulation aided material design technologies many new kinds of energetic materials like energetic extended solids energetic ionic salts energetic metal organic frames energetic co crystals and energetic perovskites have been created in addition to traditional energetic molecular crystals It is somewhat dazzling and an issue of how we can understand these new types of energetic materials is raised In the past about 20 years we were immersed in the computational energetic materials By means of defining a concept of intrinsic structures of energetic materials which refers to the crystal packing structure of energetic materials as well as molecule for molecular solid specially the microscopic structures have been mostly clarified and related with many macroscopic properties and performances with molecular simulations This book presents our understanding about it Thereby a simply and new way to readily understand energetic materials is expected to be paved based on this book It contains energetic molecular crystals energetic ionic crystals energetic atomic crystals energetic metallic crystals and energetic mixed type crystals and the substructures closest to crystal packing Meanwhile the common intermolecular interactions in energetic crystals will be introduced In addition theoretical and simulation methods for treating the intrinsic structures will be briefed as they are the main tools to reveal the molecules and crystals Besides the polymorphism as a level of intrinsic structures will be briefly discussed In the final of this book we introduce the crystal engineering of energetic materials This book features the first proposal of intrinsic structure and crystal engineering of energetic materials and the understanding of the properties and performances of energetic materials by maintaining a concept that structure determines property It helps to promote the rationality in creating new energetic materials rather than increase experience **High Energy Materials** Jai Prakash Agrawal, 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

Nano and Micro-Scale Energetic Materials Weiqiang Pang, Luigi T. DeLuca, 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 EMs technology Covering nEMs and 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

Aerogels Handbook Michel Andre Aegerter, Nicholas Leventis, Matthias M. Koebel, 2011-06-10 Aerogels are the lightest solids known Up to 1000 times lighter than glass and with a density as low as only four times that of air they show very high thermal electrical and acoustic insulation values and hold many entries in Guinness World Records Originally based on silica R D efforts have extended this class of materials to non silicate inorganic oxides natural and synthetic organic polymers carbon metal and ceramic materials etc Composite systems involving polymer crosslinked aerogels and interpenetrating hybrid networks have been developed and exhibit remarkable mechanical strength and flexibility Even more exotic aerogels based on clays chalcogenides phosphides quantum dots and biopolymers such as chitosan are opening new applications for the construction transportation energy defense and healthcare industries Applications in electronics chemistry mechanics engineering energy production and storage sensors medicine nanotechnology military and aerospace oil and gas recovery thermal insulation and household uses are being developed with an estimated annual market growth rate of around 70% until 2015 The Aerogels Handbook summarizes state of the art developments and processing of inorganic organic and composite

aerogels including the most important methods of synthesis characterization as well as their typical applications and their possible market impact Readers will find an exhaustive overview of all aerogel materials known today their fabrication upscaling aspects physical and chemical properties and most recent advances towards applications and commercial products some of which are commercially available today Key Features Edited and written by recognized worldwide leaders in the field Appeals to a broad audience of materials scientists chemists and engineers in academic research and industrial R D Covers inorganic organic and composite aerogels Describes military aerospace building industry household environmental energy and biomedical applications among others

Energetic Polymers How Ghee Ang, Sreekumar Pisharath, 2012-03-26 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

Nanomaterials in Rocket Propulsion Systems Qi-Long Yan, Guo-Qiang He, Pei-Jin Liu, Michael Gozin, 2018-10-16 *Nanomaterials in Rocket Propulsion Systems* covers the fundamentals of nanomaterials and examines a wide range of innovative applications presenting the current state of the art in the field Opening with a chapter on nano sized energetic materials the book examines metal nanoparticles based fuels ballistic modifiers stabilizers and catalysts as the components of rocket propellants Hydrogen storage materials for rocket propulsion based on nanotubes are then discussed as are nano porous materials and metal organic frameworks nano gelled propellants nano composite ablators and ceramic nano composites Other applications examined include high thermal conductivity metallic nano composite nozzle liners nano emitters for Coulomb propulsion of space crafts and highly thermostable nano ceramics for rocket motors The book finishes with coverage of combustion of nano sized rocket fuels nano particles and their combustion in micro and nano electromechanical systems MEMS NEMS plasma propulsion and nano scale physics Users will find this to be a valuable resource for academic and government institutions professionals new researchers and graduate students working in the application of nanomaterials in the aerospace industry Provides a detailed overview of different types of nanomaterials used in rocket propulsion highlighting different situations in which different materials are used Demonstrates the use of new nanomaterial concepts allowing for an increase in payload capacity or a decrease in launch mass Explores a range of applications using metal nanopowders presenting a panorama on cutting edge technological developments

The ELSI Handbook of Nanotechnology Chaudhery Mustansar Hussain, 2020-03-31 This Handbook focuses on the recent advancements

in Safety Risk Ethical Society and Legal Implications ES&I as well as its commercialization of nanotechnology such as manufacturing Nano is moving out of its relaxation phase of scientific route and as new products go to market organizations all over the world as well as the general public are discussing the environmental and health issues associated with nanotechnology Nongovernmental science organizations have long since reacted however now the social sciences have begun to study the cultural portent of nanotechnology Societal concerns and their newly constructed concepts show nanoscience interconnected with the economy ecology health and governance This handbook addresses these new challenges and is divided into 7 sections Nanomaterials and the Environment Life Cycle Environmental Implications of Nanomanufacturing Bioavailability and Toxicity of Manufactured Nanoparticles in Terrestrial Environments Occupational Health Hazards of Nanoparticles Ethical Issues in Nanotechnology Commercialization of Nanotechnology Legalization of Nanotechnology *Handbook of Continuous Crystallization* Nima Yazdanpanah,Zoltan K Nagy,2020-02-04 Continuous crystallization is an area of intense research with particular respect to the pharmaceutical industry and fine chemicals Improvements in continuous crystallization technologies offer chemical industries significant financial gains through reduced expenditure and operational costs and consistent product quality Written by well known leaders in the field The Handbook of Continuous Crystallization presents fundamental and applied knowledge with attention paid to application and scaling up and the burgeoning area of process intensification Beginning with concepts around crystallization techniques and control strategies the reader will learn about experimental methods and computational tools Case studies spanning fine and bulk chemicals the pharmaceutical industry and employing new mathematical tools put theory into context Ceramics Science and Technology, Volume 3 Ralf Riedel,I-Wei Chen,2011-12-15 Although ceramics have been known to mankind literally for millennia research has never ceased Apart from the classic uses as a bulk material in pottery construction and decoration the latter half of the twentieth century saw an explosive growth of application fields such as electrical and thermal insulators wear resistant bearings surface coatings lightweight armour or aerospace materials In addition to plain hard solids modern ceramics come in many new guises such as fabrics ultrathin films microstructures and hybrid composites Built on the solid foundations laid down by the 20 volume series Materials Science and Technology Ceramics Science and Technology picks out this exciting material class and illuminates it from all sides Materials scientists engineers chemists biochemists physicists and medical researchers alike will find this work a treasure trove for a wide range of ceramics knowledge from theory and fundamentals to practical approaches and problem solutions *Modeling and Simulation in Industrial Engineering* Mangey Ram,J. Paulo Davim,2017-08-11 This book describes the latest research developments in modeling and simulation in industrial engineering Topics such as decision and performance analysis and industrial control systems are described Case studies in industry and services as well as engineering economy and cost estimation are also covered **Chemistry of Explosives** Jacqueline Akhavan,2022-03-07 This concise easy to read book outlines the basic principles needed to understand

the chemical mechanisms of explosion Written for students with no previous knowledge of explosives but some understanding of chemical reactions in mind it takes the reader through the history of explosives and introduces the concepts of high explosives propellants and pyrotechnics Covering combustion deflagration and detonation ignition initiation and thermal decomposition thermochemistry thermodynamics and kinetics the text includes detailed formulations and reactions presented with thermochemical calculations to aid understanding This edition includes environmental legislation and its impact on explosives together with a section on safety hazard tests It also contains the latest developments in synthesis and manufacturing of explosives Covering all aspects of the properties of explosives The Chemistry of Explosives is a unique text which introduces difficult subjects in a readable manner Ideal for A level students and new graduates with no previous knowledge of explosive materials it will also be useful to anyone needing succinct information on the subject such as the more experienced chemist in the explosives sector

Nanoenergetic Materials Djatal Trache, Luigi T. DeLuca, 2021-03-25

This highly informative and carefully presented book discusses the preparation processing characterization and applications of different types of nanoenergetic materials as well as the tailoring of their properties It gives an overview of recent advances of outstanding classes of energetic materials applied in the fields of physics chemistry aerospace defense and materials science among others The content of this book is relevant to researchers in academia and industry professionals working on the development of advanced nanoenergetic materials and their applications

Chemical Rocket Propulsion

Luigi T. De Luca, Toru Shimada, Valery P. Sinditskii, Max Calabro, 2016-08-19 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

Organic Azides Stefan Bräse, Klaus Banert, 2011-09-23 Most current state of the art overview of this important class of compounds encompassing many new and emerging applications The number of articles on organic azides continues to increase tremendously on average there are more than 1000 new publications a year Covers basic chemistry as well as state of the art applications in life science and materials science World ranked authors describe their own research in the wider context of azide chemistry Includes a chapter on safe synthesis and handling azides

can decompose explosively **Developments in Combustion Technology** Konstantinos Kyprianidis, Jan Skvaril, 2016-10-05 Over the past few decades exciting developments have taken place in the field of combustion technology The present edited volume intends to cover recent developments and provide a broad perspective of the key challenges that characterize the field The target audience for this book includes engineers involved in combustion system design operational planning and maintenance Manufacturers and combustion technology researchers will also benefit from the timely and accurate information provided in this work The volume is organized into five main sections comprising 15 chapters overall Coal and Biofuel Combustion Waste Combustion Combustion and Biofuels in Reciprocating Engines Chemical Looping and Catalysis Fundamental and Emerging Topics in Combustion Technology Energetic Materials Mark J. Mezger, Kay J. Tindle, Michelle Pantoya, Lori J. Groven, Dilhan Kalyon, 2017-07-06 This book will take an in depth look at the technologies processes and capabilities to develop and produce next generation energetic materials for both commercial and defense applications including military mining operations oil production and well perforation and construction demolition It will serve to highlight the critical technologies latest developments and the current capability gaps that serve as barriers to military fielding or transition to the commercial marketplace It will also explain how the processing technologies can be spun out for use in other non energetics related industries

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