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## **KEY=EXPLOSIVES - SAWYER CLARKE**

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### **THE CHEMISTRY OF EXPLOSIVES**

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*Royal Society of Chemistry* **A unique text which introduces difficult subjects in a readable manner, covering all aspects of explosive chemistry from history to manufacturing techniques and formulation.**

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### **CHEMISTRY OF PYROTECHNICS**

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### **BASIC PRINCIPLES AND THEORY, SECOND EDITION**

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*CRC Press* **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.

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## **ORGANIC CHEMISTRY OF EXPLOSIVES**

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*John Wiley & Sons* *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.

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## **THE CHEMISTRY OF POWDER AND EXPLOSIVES**

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## **PROPELLANTS AND EXPLOSIVES**

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## THERMOCHEMICAL ASPECTS OF COMBUSTION

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*John Wiley & Sons* 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.

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## THE CHEMISTRY OF EXPLOSIVES

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*Royal Society of Chemistry* This concise, easy-to-read book outlines the basic principles needed to understand the chemical mechanisms of explosion. Covering detonation, deflagration, initiation, the latest theories on the production of "hotspots", thermochemistry, thermodynamics and kinetics, the text includes detailed formulations and reactions presented with thermochemical calculations to aid understanding. The history, theory and chemical types of explosives are introduced, along with propellants, pyrotechnics and the most up-to-date information on energetic binders for explosive compositions. Covering all aspects of explosive chemistry from history to manufacturing techniques and formulation, 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.

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## INTRODUCTION TO THE TECHNOLOGY OF EXPLOSIVES

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*John Wiley & Sons* Introduction to the Technology of Explosives Paul W. Cooper and Stanley R. Kurowski Introduction to the Technology of Explosives is a clear and concise survey of the technologies and physical processes involved in explosive phenomena. The book is intended to provide the worker new to the field with sufficient background to understand problems that may arise and to interact intelligently with specialists in the field. The book covers the fundamentals of the chemistry of explosives; the mechanics of burning; sound, shock, and detonation; initiation and initiators; scaling in design and analysis; and off-the-shelf explosive devices. It provides the basic calculational skills

needed to solve simple, first-order engineering design problems, and emphasizes the crucial importance of safety considerations. The book contains a broad range of data on explosive materials, and their properties and behavior, along with extensive lists of useful references. Example problems with solutions are provided in each technical area, as are descriptions and analysis of a wide variety of explosive devices. The book concludes with a thorough and comprehensive description of regulatory requirements for the classification, transportation, and storage of explosives, and an extensive guide to explosives safety in plant and test facilities. This book will be of interest to explosives technicians and engineers, government regulators, crime and accident scene investigators, and instructors in military, police, and FBI bomb schools.

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### **THE PREPARATORY MANUAL OF EXPLOSIVES**

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An invaluable reference manual providing quick answers to the preparation of 121 explosives, and dozens of corresponding explosives compositions. The manual is perfect for students, researchers, and truth gatherers. The manual also includes a comprehensive tutorial for laboratory techniques, and procedures including distillation, extraction, and recrystallization. This manual will help the reader better understand the art of explosives, and the chemistry there of.

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### **HIGH ENERGY MATERIALS**

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### **PROPELLANTS, EXPLOSIVES AND PYROTECHNICS**

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*John Wiley & Sons* 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.

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## **BOOM!**

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### **THE CHEMISTRY AND HISTORY OF EXPLOSIVES**

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*Chicago Review Press* **Black powder, the world's first chemical explosive, was originally developed during the Tang dynasty in China. It was a crude mixture at first, but over time chemists discovered the optimum proportion of sulfur, charcoal, and nitrates, as well as the best way to mix them for a complete and powerful reaction. Author and chemistry buff Simon Quellen Field takes readers on a decades-long journey through the history of things that go boom, from the early days of black powder to today's modern plastic explosives. Not just the who, when, and why, but also the how. How did Chinese alchemists come to create black powder? What accidents led to the discovery of high explosives? How do explosives actually work on a molecular scale? Boom! The Chemistry and History of Explosives reviews the original papers and patents written by the chemists who invented them, to shed light on their development, to explore the consequences of their use for good and ill, and to give the reader a basic understanding of the chemistry that makes them possible.**

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### **PRIMARY EXPLOSIVES**

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*Springer Science & Business Media* **This is the first comprehensive overview of this topic. It serves as a single source for information about the properties, preparation, and uses of all relevant primary explosives. The first chapter provides background such as the basics of initiation and differences between requirements on primary explosives used in detonators and igniters. The authors then clarify the influence of physical characteristics on explosive properties, focusing on those properties required for primary explosives. Furthermore, the issue of sensitivity is discussed. All the chapters on particular groups of primary explosives are structured in the same way, including introduction, physical and chemical properties, explosive properties, preparation and documented use. The authors thoroughly verified all data and information. A unique feature of this book are original microscopic images of some explosives.**

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### **THERMAL DECOMPOSITION AND COMBUSTION OF EXPLOSIVES AND PROPELLANTS**

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*CRC Press* **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.

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## **EXPLOSIVES**

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*John Wiley & Sons* The unrivaled, definitive reference for almost 40 years, this classic work on explosives is now in its seventh, completely revised and updated edition. Some 500 monographic entries, arranged alphabetically, consider the physicochemical properties, production methods, and safe applications of over 120 explosive chemicals. In addition, 70 fuels, additives, and oxidizing agents are discussed as well as the corresponding test methods. Trade, company, and military short names are provided for many of the materials listed, while further key features include a combined index and glossary with terms and abbreviations in English, French, and German, as well as conversion tables and many literature references. Finally, this indispensable source also contains safety data and transport regulations.

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## **REDUCING THE THREAT OF IMPROVISED EXPLOSIVE DEVICE ATTACKS BY RESTRICTING ACCESS TO EXPLOSIVE PRECURSOR CHEMICALS**

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*National Academies Press* Improvised explosive devices (IEDs) are a type of unconventional explosive weapon that can be deployed in a variety of ways, and can cause loss of life, injury, and property damage in both military and civilian environments. Terrorists, violent extremists, and criminals often choose IEDs because the ingredients, components, and instructions required to make IEDs are highly accessible. In many cases, precursor chemicals enable this criminal use of IEDs because they are used in the manufacture of homemade explosives (HMEs), which are often used as a

component of IEDs. Many precursor chemicals are frequently used in industrial manufacturing and may be available as commercial products for personal use. Guides for making HMEs and instructions for constructing IEDs are widely available and can be easily found on the internet. Other countries restrict access to precursor chemicals in an effort to reduce the opportunity for HMEs to be used in IEDs. Although IED attacks have been less frequent in the United States than in other countries, IEDs remain a persistent domestic threat. Restricting access to precursor chemicals might contribute to reducing the threat of IED attacks and in turn prevent potentially devastating bombings, save lives, and reduce financial impacts. *Reducing the Threat of Improvised Explosive Device Attacks by Restricting Access to Explosive Precursor Chemicals* prioritizes precursor chemicals that can be used to make HMEs and analyzes the movement of those chemicals through United States commercial supply chains and identifies potential vulnerabilities. This report examines current United States and international regulation of the chemicals, and compares the economic, security, and other tradeoffs among potential control strategies.

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## **EXPLOSIVE EFFECTS AND APPLICATIONS**

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*Springer Science & Business Media* This is a broad-based text on the fundamentals of explosive behavior and the application of explosives in civil engineering, industrial processes, aerospace applications, and military uses.

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## **A COMPREHENSIVE GUIDE TO THE HAZARDOUS PROPERTIES OF CHEMICAL SUBSTANCES**

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*John Wiley & Sons* The definitive guide to the hazardous properties of chemical compounds Correlating chemical structure with toxicity to humans and the environment, and the chemical structure of compounds to their hazardous properties, *A Comprehensive Guide to the Hazardous Properties of Chemical Substances, Third Edition* allows users to assess the toxicity of a substance even when no experimental data exists. Thus, it bridges the gap between hazardous materials and chemistry. Extensively updated and expanded, this reference: Examines organics, metals and inorganics, industrial solvents, common gases, particulates, explosives, and radioactive substances, covering everything from toxicity and carcinogenicity to flammability and explosive reactivity to handling and disposal practices Arranges hazardous chemical substances according to their chemical structures and functional groups for easy reference Includes updated information on the toxic, flammable, and explosive properties of chemical substances Covers additional metals in the chapters on toxic and reactive metals Updates the threshold exposure limits in the workplace air for a number of substances Features the latest information on industrial solvents and toxic and flammable gases

Includes numerous tables, formulas, and a glossary for quick reference. Because it provides information that enables those with a chemistry background to perform assessments without prior data, this comprehensive reference appeals to chemists, chemical engineers, toxicologists, and forensic scientists, as well as industrial hygienists, occupational physicians, Hazmat professionals, and others in related fields.

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## **CHEMICAL MAGIC**

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*Courier Corporation* Classic guide provides intriguing entertainment while elucidating sound scientific principles, with more than 100 unusual stunts: cold fire, dust explosions, a nylon rope trick, a disappearing beaker, much more.

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## **CHEMISTRY OF PYROTECHNICS**

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## **BASIC PRINCIPLES AND THEORY, THIRD EDITION**

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*CRC Press* This book provides chemists with technical insight on pyrotechnics and explosives. It emphasizes basic chemical principles and practical, hands-on knowledge in the preparation of energetic materials. It examines the interactions between and adaptations of pyrotechnics to changing technology in areas such as obscuration science and low-signature flame emission. The updated third edition discusses chemical and pyrotechnic principles, components of high-energy materials, 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.

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## **COMBUSTION**

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*Academic Press* Throughout its previous four editions, *Combustion* has made a very complex subject both enjoyable and understandable to its student readers and a pleasure for instructors to teach. With its clearly articulated physical and chemical processes of flame combustion and smooth, logical transitions to engineering applications, this new edition continues that tradition. Greatly expanded end-of-chapter problem sets and new areas of combustion engineering applications make it even easier for students to grasp the significance of combustion to a wide range of engineering practice, from transportation to energy generation to environmental impacts. Combustion engineering is the study of rapid energy and mass transfer usually through the common physical phenomena of flame oxidation. It covers the

physics and chemistry of this process and the engineering applications—including power generation in internal combustion automobile engines and gas turbine engines. Renewed concerns about energy efficiency and fuel costs, along with continued concerns over toxic and particulate emissions, make this a crucial area of engineering. New chapter on new combustion concepts and technologies, including discussion on nanotechnology as related to combustion, as well as microgravity combustion, microcombustion, and catalytic combustion—all interrelated and discussed by considering scaling issues (e.g., length and time scales) New information on sensitivity analysis of reaction mechanisms and generation and application of reduced mechanisms Expanded coverage of turbulent reactive flows to better illustrate real-world applications Important new sections on stabilization of diffusion flames—for the first time, the concept of triple flames will be introduced and discussed in the context of diffusion flame stabilization

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## THE BASICS OF EXPLOSIVES

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## THE CHEMISTRY OF EXPLOSIVE COMPOUNDS

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*Createspace Independent Publishing Platform* Explosives are used around the world for both productive purposes such as building hydroelectric dams and mining and destructive purposes, primarily by the military. Explosives are usually divided into two classes those that burn and those that detonate. Detonated explosives typically produce a shock front or shock wave that results from an exothermic chemical reaction. This chemical reaction usually results in a relatively stable compound being exposed to a concentrated source of energy such as a blasting cap or other type of detonation device. The solid explosive will phase shift to a high temperature expanding gas in approximately one-millionth of a second (a nanosecond) with pressures exceeding several million pounds per square inch. For one example we can examine 'Det Cord', also known as Primacord which is usually produced in rolled up or coiled section of cord. This cord is then unwound and when detonated will produce an explosive front along the length of the cord that travels at the speed of 5 miles per second. In other words, if you laid out 5 miles of Det cord, and detonated it, the 5 miles of cord would be explosively spent in one second. Whereas if you burned or ignited the same amount cord it could take weeks to burn to completion. This 2 volume set explains the nature of the various industrial and military explosives and also discusses some of the chemistry involved in these explosives - particularly in the 2nd volume.

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## HIGH EXPLOSIVES, PROPELLANTS, PYROTECHNICS

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*Walter de Gruyter GmbH & Co KG* 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.

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## **COMBUSTION, FLAMES AND EXPLOSIONS OF GASES**

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*Academic Press* **Combustion, Flames, and Explosions of Gases, Second Edition** focuses on the processes, methodologies, and reactions involved in combustion phenomena. The publication first offers information on theoretical foundations, reaction between hydrogen and oxygen, and reaction between carbon monoxide and oxygen. Discussions focus on the fundamentals of reaction kinetics, elementary and complex reactions in gases, thermal reaction, and combined hydrogen-carbon monoxide-oxygen reaction. The text then elaborates on the reaction between hydrocarbons and oxygen and combustion waves in laminar flow. The manuscript tackles combustion waves in turbulent flow and air entrainment and burning of jets of fuel gases. Topics include effect of turbulence spectrum and turbulent wrinkling on combustion wave propagation; ignition of high-velocity streams by hot solid bodies; burners with primary air entrainment; and description of jet flames. The book then takes a look at detonation waves in gases; emission spectra, ionization, and electric-field effects in flames; and methods of flame photography and pressure recording. The publication is a valuable reference for readers interested in combustion phenomena.

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## **EXPLOSIVES AND HOMEMADE BOMBS**

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## CHEMISTRY OF HIGH-ENERGY MATERIALS

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*Walter de Gruyter GmbH & Co KG* 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.

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## THE ANALYSIS OF EXPLOSIVES

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### PERGAMON SERIES IN ANALYTICAL CHEMISTRY

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*Elsevier* The Analysis of Explosives surveys the principles of the various analytical methods, describes how these methods are used for the analysis of explosives, and reviews the major analytical work carried out in this field. Organized into 15 chapters, this book begins with the classification of explosives. Subsequent chapters discuss the different methods for the analysis of explosives. The detection and identification of explosive residues and hidden explosives are also explained. This monograph will be useful as a reference book for chemists in analytical and forensic laboratories, as well as a textbook for graduate students in analytical chemistry and forensic sciences.

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## DETONATION OF CONDENSED EXPLOSIVES

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*Springer Science & Business Media* This work marks a stage in the evolution of a scientific and technical field which has been developed by the Commissariat a l'Energie Atomique (CEA) over several decades. Many members of the staff of the CEA have won re nown in this field, and their work has brought it to the high degree of excel lence for which it is internationally recognized today. These scientists had to consider every aspect of the field, as it concerned: modeling, which has recourse to fluid thermodynamics, molecular phys ics, and chemistry; numerical evaluation, which relies on mathematical analysis and data processing; and experiments in the firing area, which require specific stress generators and instrumentation. Whilst this book is a testament to the activity and success of staff of the CEA, it also reviews a number ofthe advances made in the discipline. How ever, it is not intended to be an exhaustive account of those advances; it is assumed that the reader can, if desired, consult the standard monographs, and more recent, more specialized works (notably W.C. Davis and W. Fickett, and C.L. Mader). The history of the discipline is interesting in itself, and also as an illustra tion of the causes which lead to progress in a coherent body of scientific work. I should

like to make some comments on this progress, of which there is a fascinating summary in the introduction, and which will figure largely throughout the work.

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## **ASPECTS OF EXPLOSIVES DETECTION**

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*Elsevier* Detection and quantification of trace chemicals is a major thrust of analytical chemistry. In recent years much effort has been spent developing detection systems for priority pollutants. Less mature are the detections of substances of interest to law enforcement and security personnel: in particular explosives. This volume will discuss the detection of these, not only setting out the theoretical fundamentals, but also emphasizing the remarkable developments in the last decade. Terrorist events—airplanes blown out of the sky (PanAm 103 over Lockerbie) and attacks on U.S. and European cities (Trade Center in New York and the Murrah Federal Building in Oklahoma City, railways in London and Madrid)—emphasize the danger of concealed explosives. However, since most explosives release little vapor, it was not possible to detect them by technology used on most organic substances. After PanAm 103 was downed over Scotland, the U.S. Congress requested automatic explosive detection equipment be placed in airports. This volume outlines the history of explosive detection research, the developments along the way, present day technologies, and what we think the future holds. - Written by experts in the field who set out both the scientific issues and the practical context with authority - Discusses and describes the threat - Describes the theoretical background and practical applications of both trace and bulk explosives detection

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## **MILITARY PYROTECHNICS**

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## **PRINCIPLES AND PRACTICES**

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*CRC Press* This book covers military pyrotechnics characteristics, sensitivity, combustion, performance parameters, ingredients and their behaviour, various pyrotechnic compositions and their manufacturing methods, filling, pressing and assembly of ammunition and so forth. Divided into two broader sections, namely military pyrotechnic compositions and military pyrotechnic ammunitions and devices, it provides full spectrum of military pyrotechnics and a guide for all personnel involved with management of military pyrotechnic ammunitions and devices in design, production, inspection, training, and use. Features: \*Answers "know what", "know why" and "know how" of pyrotechnic compositions and pyrotechnic ammunitions and devices \* Explains various concepts and mechanisms of the military pyrotechnics \*Deliberates on role and characteristics of pyrotechnic compositions and its classification \*Discusses

various factors affecting performance and some differences in military pyrotechnics \* Describes various methods of initiation of ignition in ammunition \*Elucidates basic requirements of pyrotechnic ammunitions, its development and life cycle of ammunition lots \* Provides classification, division, shelf life, compatibility and nomenclature of ammunitions and devices \*Reviews test/proof requirements of ammunitions and devices, deployment and functioning, defect classification, sampling plan and acceptance criteria \*Explores latest trends in 'green pyrotechnics' for environment- friendly military pyrotechnics

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## **EXPLOSIVES ENGINEERING**

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*John Wiley & Sons* This graduate text, and Cooper's companion introductory text ('Introduction to the Technology of Explosives'), serve the same markets as the successful explosives reference by Meyer, now in its 4th edition. VCH also published the International Journal of Propellants, Explosives, and Pyrotechnics. The resulting package would give VCH the major presence in the field. This text presents the basic technologies used in the engineering of explosives and explosive systems, i.e., chemistry, burning, detonation, shock waves, initiation theories, scaling. The book is written for upper-division undergraduate or graduate-level scientists and engineers, and assumes a good grasp of basic physics, chemistry, mechanics and mathematic through calculus. It is based on lecture notes used for graduate courses at the Dept. of Energy Laboratories, and could serve as a core text for a course at schools of mining or military engineering. The intent of the book is to provide the engineer or scientist in the field with an understanding of the phenomena involved and the engineering tools needed to solve/ design/ analyze a broad range of real problems.

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## **LIQUID EXPLOSIVES**

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*Springer* The book drawing on the author's nearly half a century of energetic materials research experience intends to systematically review the global researches on liquid explosives. The book focuses on the study of the conception, explosion mechanism, properties and preparation of liquid explosives. It provides a combination of theoretical knowledge and practical examples in a reader-friendly style. The book is likely to be interest of university researchers and graduate students in the fields of energetic materials, blasting engineering and mining.

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## **INTRODUCTION TO GREEN CHEMISTRY, SECOND EDITION**

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*CRC Press* In the nearly 10 years since the publication of the bestselling first edition of Introduction to Green Chemistry,

interest in green chemistry and clean processes has grown so much that topics, such as fluorinated biphasic catalysis, metal organic frameworks, and process intensification, barely mentioned in the first edition, have become major areas of research. In addition, government funding has ramped up the development of fuel cells and biofuels. It reflects the evolving focus from pollution remediation to pollution prevention. Copiously illustrated with over 800 figures, this second edition provides an update from the frontiers of the field. New and expanded research topics: Metal-organic frameworks Solid acids for alkylation of isobutene by butanes Carbon molecular sieves Mixed micro- and mesoporous solids Organocatalysis Process intensification and gas phase enzymatic reactions Hydrogen storage for fuel cells Reactive distillation Catalysts in action on an atomic scale Updated and expanded current events topics: Industry resistance to inherently safer chemistry Nuclear power Removal of mercury from vaccines Removal of mercury and lead from primary explosives Biofuels Uses for surplus glycerol New hard materials to reduce wear Electronic waste Smart growth The book covers traditional green chemistry topics, including catalysis, benign solvents, and alternative feedstocks. It also discusses relevant but less frequently covered topics with chapters such as Chemistry of Longer Wear and Population and the Environment. This coverage highlights the importance of chemistry to everyday life and demonstrates the benefits the expanded exploitation of green chemistry can have for society.

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## **EFFECTS OF EXPLOSIONS ON MATERIALS**

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### **MODIFICATION AND SYNTHESIS UNDER HIGH-PRESSURE SHOCK COMPRESSION**

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*Springer Science & Business Media* In the 1950s explosives began to be used to generate ultrahigh pressures in condensed substances in order to modify their properties and structure. Notwithstanding the short duration of an explosion, its energy proved to be high enough to perform physical-chemical transformations of substances, and the new method gained wide industrial applications. It has both advantages and drawbacks in comparison with the traditional method of static compression. The latter method, notorious for its cumbersome and expensive machinery, allows one to maintain high pressure as long as one pleases and to regulate the temperature of the sample arbitrarily. But, the pressure available is rather limited and for any increase of this limit one has to pay by the progressive shrinking of the working volume of a press. The dynamic method has the advantages of low cost and practically no restrictions of magnitude of pressure and the size of a processed sample, but the temperature in a compressed body is no longer controlled by an experimenter. Rather, it is firmly dictated by the level of loading, according to the equation of state. Hence, it is difficult to recover metastable products and impossible to prepare solids with a low concentration of

defects as the duration of explosion is too short for their elimination.

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### **ETHICS AND LAW FOR CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR & EXPLOSIVE CRISES**

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*Springer* This book provides a current analysis of the legal and ethical challenges in preparing for and responding to chemical, biological, radiological, nuclear and explosive (CBRNE) crises. From past events like the Chernobyl nuclear incident in Russia or the Bhopal chemical calamity in India, to the more recent tsunami and nuclear accident in Japan or the Ebola crisis in Africa, and with the on-going threat of bioterrorism, the need to be ready to respond to CBRNE crises is uncontroversial. What is controversial is whether we are on a path that adequately prepares us for the next event. The ethical and legal scholars in this volume hold that much work remains to be done and offer this book to stimulate further reflection and dialogue around CBRNE crises. This is an indispensable book for both students and scholars of bioethics, international law, public health, as well as for regulators and administrators developing policy and legislation related to public health planning and emergency responses.

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### **FORENSIC INVESTIGATION OF EXPLOSIONS, SECOND EDITION**

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*CRC Press* Now in its second edition, *Forensic Investigation of Explosions* draws on the editor's 30 years of explosives casework experience, including his work on task forces set up to investigate major explosives incidents. Dr. Alexander Beveridge provides a broad, multidisciplinary approach, assembling the contributions of internationally recognized experts who present the definitive reference work on the subject. Topics discussed include: The physics and chemistry of explosives and explosions The detection of hidden explosives The effect of explosions on structures and persons Aircraft sabotage investigations Explosion scene investigations Casework management The role of forensic scientists Analysis of explosives and their residues Forensic pathology as it relates to explosives Presentation of expert testimony With nearly 40 percent more material, this new edition contains revised chapters and several new topics, including: A profile of casework management in the UK Forensic Explosives Laboratory, one of the world's top labs, with a discussion of their management system, training procedures, and practical approaches to problem solving Properties and analysis of improvised explosives An examination of the Bali bombings and the use of mobile analytical techniques and mobile laboratories The collection, analysis, and presentation of evidence in vehicle-borne improvised explosive device cases, as evidenced in attacks on US overseas targets This volume offers valuable information to all members of prevention and post-blast teams. Each chapter was written by an expert or experts in a specific field and

provides well-referenced information underlying best practices that can be used in the field, laboratory, conference room, classroom, or courtroom.

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## **CYBER AND CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR, EXPLOSIVES CHALLENGES**

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### **THREATS AND COUNTER EFFORTS**

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*Springer* This book covers the security and safety of CBRNE assets and management, and illustrates which risks may emerge and how to counter them through an enhanced risk management approach. It also tackles the CBRNE-Cyber threats, their risk mitigation measures and the relevance of raising awareness and education enforcing a CBRNE-Cyber security culture. The authors present international instruments and legislation to deal with these threats, for instance the UNSCR1540. The authors address a multitude of stakeholders, and have a multidisciplinary nature dealing with cross-cutting areas like the convergence of biological and chemical, the development of edging technologies, and in the cyber domain, the impelling risks due to the use of malwares against critical subsystems of CBRN facilities. Examples are provided in this book. Academicians, diplomats, technicians and engineers working in the chemical, biological, radiological, nuclear, explosive and cyber fields will find this book valuable as a reference. Students studying in these related fields will also find this book useful as a reference.

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## **HANDBOOK OF FIRE & EXPLOSION PROTECTION ENGINEERING PRINCIPLES FOR OIL, GAS, CHEMICAL, & RELATED FACILITIES**

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*William Andrew* The security and economic stability of many nations and multinational oil companies are highly dependent on the safe and uninterrupted operation of their oil, gas and chemical facilities. One of the most critical impacts that can occur to these operations are fires and explosions from accidental or political incidents. This publication is intended as a general engineering handbook and reference guideline for those personnel involved with fire and explosion protection aspects of critical hydrocarbon facilities. Design guidelines and specifications of major, small and independent oil companies as well as information from engineering firms and published industry references have been reviewed to assist in its preparation. Some of the latest published practices and research into fire and explosions have also been mentioned.

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**BREThERICK'S HANDBOOK OF REACTIVE CHEMICAL HAZARDS**

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**AN INDEXED GUIDE TO PUBLISHED DATA**

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*Elsevier* 'Bretherick' is widely accepted as the reference work on reactive chemical hazards and is essential for all those working with chemicals. It attempts to include every chemical for which documented information on reactive hazards has been found. The text covers over 5000 elements and compounds and as many again of secondary entries involving two or more compounds. One of its most valuable features is the extensive cross referencing throughout both sections which links similar compounds or incidents not obviously related. The fifth edition has been completely updated and revised by the new Editor and contains documented information on hazards and appropriate references up to 1994, although the text still follows the format of previous editions. Volume 1 is devoted to specific information on the stability of the listed compounds, or the reactivity of mixtures of two or more of them under various circumstances. Each compound is identified by an UPAC-based name, the CAS registry number, its empirical formula and structure. Each description of an incident or violent reaction gives reference to the original literature. Each chemical is classified on the basis of similarities in structure or reactivity, and these groups are listed alphabetically in Volume 2. The group entries contain a complete listing of all the compounds in Volume 1 assigned to that group to assist cross referral to similar compounds. Volume 2 also contains hazard topic entries arranged alphabetically, some with lists. Appendices include a fire related data table for higher risk chemicals, indexes of registry numbers and chemical names as well as reference abbreviations and a glossary.

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**CHEMISTRY AND TECHNOLOGY OF EXPLOSIVES**

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*Pergamon*

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**COUNTERTERRORIST DETECTION TECHNIQUES OF EXPLOSIVES**

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*Elsevier* Counterterrorist Detection Techniques of Explosives, Second Edition covers the most current techniques available for explosive detection. This completely revised volume describes the most updated research findings that will be used in the next generation of explosives detection technologies. New editors Drs. Avi Cagan and Jimmie Oxley have assembled in one volume a series of detection technologies written by an expert group of scientists. The book helps researchers to compare the advantages and disadvantages of all available methods in detecting explosives and,

in effect, allows them to choose the correct instrumental screening technology according to the nature of the sample. Covers bulk/remote trace/contact or contact-less detection Describes techniques applicable to indoor (public transportation, human and freight) and outdoor (vehicle) detection Reviews both current techniques and those in advanced stages of development Provides detailed descriptions of every technique, including its principles of operation, as well as its applications in the detection of explosives

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## **ENERGETIC COMPOUNDS**

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### **METHODS FOR PREDICTION OF THEIR PERFORMANCE**

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*Walter de Gruyter GmbH & Co KG* Since the synthesis and development of new energetic materials require identification of promising candidates for additional study and elimination of poor candidates from further consideration, it is important for engineers, scientists and industries to assess the performance of the new compounds for reducing costs associated with synthesis, testing and evaluation of these materials. Nowadays different approaches have been used to predict the performance of energetic compounds, which can be recognized to be cost-effective, environmentally-desirable and time-saving capabilities. This book reviews different methods for the assessment of the performance of an energetic compound through its heat of detonation, detonation pressure, detonation velocity, detonation temperature, Gurney energy and power (strength). The book also focuses on the detonation pressure and detonation velocity of non-ideal aluminized energetic compounds. Simple and reliable methods are demonstrated in detail where they can be easily used for the design, synthesis and development of novel energetic compounds.