Detection Of Liquid Explosives And Flammable Agents In Connection With Terrorism Nato Science For Peace And Security Series B Physics And Biophysics

A comprehensive guide to training and certifying K9 explosive detection teams Learn how to: - Train your K9 to detect and safely alert for explosive substances. - Conduct operational searches in buildings, vehicles, ships, and planes. - Train your dog for the specialized work of mine detection. In the high stakes realm of explosive detection, where even the smallest mistake can have fatal consequences, the margin of error is zero. Well trained dog-handler teams can play a key role in explosive detection, but only if their training is top notch. Dr. Resi Gerritsen and Ruud Haak have worked with police departments around the world to help them establish and improve their K9 explosive detection training programs, and in this book they share their expertise with handlers and trainers looking to enhance their own performance. They teach how to pick the right dog for explosive detection work, how to train the dog to detect explosives, and how to properly execute a variety of training and operational searches. They also provide some of the background knowledge you'll need about common explosives and the many factors that can influence a K9's work. Along with essential health and safety precautions for you and your dog, you'll also learn how to test and certify dogs and handlers to ensure excellent performance in the field.

The Inverse Fan-beam (IF) confi guration for X-ray Diffraction Imaging (XDI) and its capability of identifying liquid and amorphous substances for the purpose of explosive detection are described and investigated. Material specifi c information can be obtained by measuring x-ray diffraction profi-les from selected volume elements within inhomogeneous extended objects. This new technique can be used to fi ngerprint liquid explosives and may eliminate the inconvenience, uncertainty, and expense associated with monitoring liquids separately from hand luggage at airport checkpoints. Design concepts for multi-detector arrangements, a multidirectional primary collimator and the scatter imaging collimator are presented and evaluated using numerical procedures. A computer program using ray-tracing methods is described for calculating the primary beam profi le, the scattering angle distribution, and the radiation effi ciency with respect to the x-ray collimation geometry. Synchrotron x-ray diffraction measurements were performed on various liquids which are of interest for security applications. The diffraction profi les are presented and the key features which are potentially suitable for the purpose of explosive detection identifi ed. Material specific information is obtained about the morphology and its effective atomic number. Several additional parameters describing the structure and density of the object under investigation can be derived from the peaks in the molecular interference function.

Since the turn of the twenty-first century, applications of ion mobility spectrometry (IMS) have diversified, expanding their

utility in the military and security spheres and entering the realms of clinical practice and pharmaceutical exploration. Updated and expanded, the third edition of Ion Mobility Spectrometry begins with a comprehensive discussion of the fundamental theory and practice of IMS. Divided into four sections—Overview, Technology, Fundamentals, and Applications—the authors treat innovations and advances in all aspects of IMS in a fresh, thorough, and revised format. Features: Introduces the definitions, theory, and practice of IMS and summarizes its history from the beginnings of the study of ions to present commercial and scholarly activities Presents the technology of IMS from a measurement perspective—covering inlet through ion formation, ion injection, electric fields, drift tube structures, and detectors Covers the end results of measurement, the mobility spectrum, and the transformative trend of ion mobility: mass spectrometry Discusses the influence on the experimental parameters on the mobility of ions Mobility-based methods are no longer restricted to volatile substances and indeed the many benefits of this technology—simplicity, convenience, and the low cost of technology—have become recognized as meritorious in a wide range of uses. This is also true for the advantages of measurements—high speed, distinctive spectral features, and operation in ambient pressure with thermalized ions. Ion Mobility Spectrometry, Third Edition serves specialists in the field of IMS who are interested in the potential of recent developments and researchers, engineers, and students who want a comprehensive overview of this technology.

The new, fully colored standard in Biophotonics to serve as THE reference for the scientific basics and the latest applications in life science!

Detection of concealed explosives is a notoriously difficult problem, and many different approaches have been proposed to solve this problem. Nuclear quadrupole resonance (NQR) is unique in many ways. It operates in a safe AM radio frequency range, and it can remotely detect unique “fingerprint” (NQR spectrum) of many explosives, such as TNT or RDX. As such, the detection of target does not depend on the shape or material of the container, or the presence of metallic object such as triggers etc. Spectra of chemically similar compounds differ enough that their presence never causes interference or false alarms. Unfortunately, widespread use is prevented due to low sensitivity, radiofrequency interference from the noisy environment, and inability to detect liquid explosives. This book presents current state of the art of the attempts to overcome NQR sensitivity problem, either by increasing the strengths of signals generated, or by increasing the specificity of the technique through a better understanding of the factors that affect the quadrupolar parameters of specific explosives. The use of these specific quadrupolar parameters is demonstrated on signal processing techniques that can detect weak signals, which are hidden in a noisy background. The problem of differentiation of liquid explosives and benign liquids in closed containers is approached by measurements of different nuclear magnetic resonance (NMR) parameters. As shown, a couple of solutions has reached a prototype stage and

could find their use in a near future.

"Revised and expanded to reflect new developments in the field, this book outlines the basic principles required to understand the chemical processes of explosives. The Chemistry of Explosives provides an overview of the history of explosives, taking the reader to future developments. The text on the classification of explosive materials contains much data on the physical parameters of primary and secondary explosives. The explosive processes of deflagration and detonation, including the theory of 'hotspots' for the detonation process, are introduced and many examples are provided in the detailed description on the thermochemistry of explosives. New material includes coverage of the latest explosive compositions, such as high temperature explosives, nitrocubanes, energetic polymers, plasticizers and insensitive munitions (IM). This concise, readable book is ideal for 'A' level students and new graduates with no previous knowledge of explosive materials. With detailed information on a vast range of explosives in tabular form and an extensive bibliography, this book will also be useful to anyone needing succinct information on the subject."

In response to the rising concern of the American public over illegal bombings, the Bureau of Alcohol, Tobacco, and Firearms asked the National Research Council to examine possible mechanisms for reducing this threat. The committee examined four approaches to reducing the bombing threat: addition of detection markers to explosives for pre-blast detection, addition of identification taggants to explosives for post-blast identification of bombers, possible means to render common explosive materials inert, and placing controls on explosives and their precursors. The book makes several recommendations to reduce the number of criminal bombings in this country.

Detection of Liquid Explosives and Flammable Agents in Connection with TerrorismSpringer Science & Business Media

Nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI) methods are widely used in medicine, chemistry and industry. Over the past several years there has been increasing interest in performing NMR and MRI in the ultra-low field (ULF) regime, with measurement field strengths of 10-100 microTesla and pre-polarization fields of 30-50 mTesla. The real-time signal-to-noise ratio for such measurements is about 100. Our group at LANL has built and demonstrated the performance of SQUID-based ULF NMR/MRI instrumentation for classification of materials and detection of liquid explosives via their relaxation properties measured at ULF, using T1, and T2, and T1 frequency dispersion. We are also beginning to investigate the performance of induction coils as sensors. Here we present recent progress on the applications of ULF MR to the detection of liquid explosives, in imaging and relaxometry.

Detection of Bulk Explosives: Advanced Techniques against Terrorism contains reviews of: existing and emerging bulk explosives detection techniques; scientific and technical policy of the Federal Border Service of the Russian Federation; challenges in application and evaluation of EDS systems for aviation security; multi-sensor approach to explosives detection. There are also reports devoted to the following individual explosive detection techniques: X-ray systems in airports; neutron in, gamma out

techniques; neutron and gamma backscattering; nuclear quadruple resonance, including remote NQR; sub-surface radars; microwave scanners; laser-induced burst spectroscopy (LIBS); acoustic sensors; nonlinear location (NUD); systems for localization and destruction of explosive objects.

The organization of an Advanced Research Workshop with the title “Detection and Disposal of Liquid Explosives and Flammable Agents in Connection with Terrorism” was motivated by international findings about activities in this field of application. This ARW followed a meeting about the “Detection of Disposal Improvised Explosives” (St. Petersburg, 2005). Both items show the logistic problems as one of the lessons, terrorists have to overcome. These problems are connected with the illegal supply and transport of explosives and fuels and as counter-measure the detection of these materials. The invention of liquid explosives goes back to the middle of the 19th century and was used for special purposes in the commercial field of application. Because of the high sensitivity of liquid explosives against mechanical shock, caused by adiabatic compression of air-bobbles producing “hot spots” as origin of initiation the commercial application was not very successful. Because of this high risk, liquid explosives are not used in military or commercial application with some exceptions. In the commercial field explosives as slurries or emulsions consisting of suitable salts (Ammoniumnitrate etc.) and water are used to a large extend because of their high insensitivity. In many cases these slurries or emulsions were unfit for terrorist actions, because of their low sensitivity, large critical diameter and using in confinement. In the military field liquid explosives are used in World War I and II as bomb-fillings.

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

This book collects lectures of an international NATO-Russian Advanced Research Workshop on Detection and Disposal of Improvised Explosives (IE) used by terrorists. The disposal of IE is especially dangerous, because they are often much more unstable and mechanically more sensitive than commercial or military explosives. This text covers detection of explosives by different analytical methods and the different shape and compositions of the explosive charge, and offers up-to-date advice on handling and disposal.

This book will provide a survey of the major areas in which information derived from vibrational spectroscopy investigations and

studies have contributed to the benefit of forensic science, either in a complementary or a unique way. This is highlighted by examples taken from real case studies and analyses of forensic relevance, which provide a focus for current and future applications and developments.

This book represents a collection of papers presented at the 4th International Symposium on Analysis and Detection of Explosives held at the Mitzpeh Rachel Kibbutz Guesthouse in Jerusalem, September 7 to 10, 1992. The Symposium was attended by 150 participants from 20 countries and 50 lectures were given including 4 invited keynote lectures. The purpose of the Symposium, as the previous Symposia, was to present and to discuss new approaches, new applications, new methods and techniques in analysis and detection of explosives. The Symposium was, according to the feedback received from many participants, very successful and met the anticipated expectations. New collaborative initiatives between various laboratories from different countries were formed, which is a necessity in our common goals of law enforcement, aviation security and environmental quality, issues which are closely related to the analysis of explosives. I would like to extend my thanks to the Weizmann Institute of Science and the Israel National Police for sponsoring the Symposium, to the contributing Institutions and Agencies for making this Symposium financially possible, and to the members of the International Committee for helpful advice. I am most thankful to my colleagues from the Organizing Committee, especially Dr. Joseph Almog and Dr. Shmuel Zitrin from the Israel National Police, for helping in the organization of this Symposium.

This highly acclaimed reference work has set worldwide standards in the field of explosives and propellant materials for the past 60 years. Now in its 4th revised English Edition it describes 120 explosive substances with their formulae, performance, sensitivity characteristics and trade names. Instructions and tables for the calculation of thermodynamic data are also included. A special feature is the short dictionary of explosive characteristics in six languages: English, German, French, Spanish, Russian and Czechoslovakian. From reviews on the 3rd English Edition: 'This wealth of information and an index that comprises some 2500 key-words and several conversion tables make this book a unique source of knowledge for anybody working with explosives.' Propellants, Explosives, Pyrotechnics. 'The objective of the book is to provide fundamental information on the subject of explosives not only to experts but also to the general public. The book will therefore, apart from industrial companies and research facilities concerned, be found useful in documentary centers, translation bureaus, editorial offices, patent and lawyer offices, and other institutions of this nature.' Mining Engineering

The Bureau of Alcohol, Tobacco and Firearms (ATF) trains canine/handler teams to detect explosives for government and other agencies worldwide. After completing the training program the teams are tested on an array containing explosives and numerous other samples designed to distract a canine. Passing this test results in a team's certification. These teams can be considered as ''detection instruments'' freshly calibrated just before leaving the ''factory''. Using these teams to examine special experimental arrays immediately following certification can lead to a better understanding of a canine's detection capabilities. Forty-one of these ''detection instruments'' were used in four test series with arrays containing dilute nitromethane-in-water solutions. (The canines had been trained on the amount of nitromethane vapor in equilibrium with the undiluted liquid explosive.) By diluting liquid nitromethane with water, the amount of explosive vapor can be reduced many orders of magnitude to test the lower limit of the canine's nitromethane vapor detection response. The results are presented in this paper.

This work presents the development of an x-ray detector system for the multispectral detection of x-rays used in a Bottle Scanner. This

system is designed to identify liquid explosives concealed within bottles taken onto aircraft. The Bottle Scanner works by calculating the transmission spectrum for a given bottle and its contents. This is then used as a fingerprinting technique in order to identify the presence of liquid explosives. The main focus of this work is the design of the detector signal chain and particularly the pulse height detection algorithms for the acquisition of 32 bin x-ray spectra. The pulse height detection algorithms are implemented on a field programmable gate array (FPGA). The performance of such algorithms at high count rate is a key requirement for this application. Four such algorithms are discussed in this work, each with varying complexity and different approaches to pile up handling. The algorithms are simulated using a Monte Carlo approach where the random arrival rate of photons at the detector is modelled. Algorithms are then emulated using an Agilent DSO90254A oscilloscope before finally being programmed onto an FPGA and tested on a real system. The transmission curves produced in real Bottle Scanner systems show a deviation from those predicted by the underlying physics and exhibit a rollover at high energies. This is shown to be due to pulse pile up effects which are explored in detail. Depth of interaction effects are also investigated experimentally and by simulation using the Geant4 software package. The results of this are used to design a biparametric type algorithm which is capable of simultaneous pile up rejection and depth of interaction correction.

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.

The detection of hidden explosives has become an issue of utmost importance in recent years. While terrorism is not new to the international community, recent terrorist attacks have raised the issue of detection of explosives and have generated a great demand for rapid, sensitive and reliable methods for detecting hidden explosives. Counterterrorist Detection Techniques of Explosives covers recent advances in this area of research including vapor and trace detection techniques (chemiluminescence, mass spectrometry, ion mobility spectrometry, electrochemical methods and micromechanical sensors, such as microcantilevers) and bulk detection techniques (neutron techniques, nuclear quadrupole resonance, x-ray diffraction imaging, millimeter-wave imaging, terahertz imaging and laser techniques). This book will be of interest to any scientists involved in the design and application of security screening technologies including new sensors and detecting devices which will prevent the smuggling of bombs and explosives. * Covers latest advances in vapor and trace detection techniques and bulk detection techniques * Reviews both current techniques and those in advanced stages of development * Techniques that are described in detail, including its principles of operation, as well as its applications in the detection of explosives

The purpose of this statement of work is for third party collaborators to train, validate and have Lawrence Livermore National Security, LLC (LLNS) evaluate algorithms to detect liquid threats in digital radiography (DR)/TIP Ready X-ray (TRX) images that will be provided by LLNS through the Transportation and Security Administration (TSA). LLNS will provide a set of images with threat(s) to determine detection rates and non-threat images from airports to determine false alarm rates. A key including a bounding box showing the locations of the threats and non-threats will be provided for the images. It is expected that the Subcontractor shall use half of the images with their keys for training the algorithms and the other half shall be used for validation (third party evaluation) purposes. The Subcontractor shall not use the key to the second half of the data other than for the validation and reporting of the performance of its algorithm (not for training). The Subcontractor has 45 business days from the receipt of datasets and the Subcontract to: (1) Run their detection/classification algorithms on the data; (2) Deliver

a final report describing their performance by generating Receiver Operator Characteristic (ROC) curves using their algorithm; and (3) Deliver a copy of the third party's executable software (already trained and validated by the datasets) to LLNL accompanied by a user manual. LLNS will evaluate the performance of the same algorithm on another separate set of data. LLNS evaluation of the Subcontractor's algorithm will be documented in a final report within 30 days of receiving the executable code. This report will be sent to TSA and the report may be disseminated to the Subcontract at TSA's discretion.

This volume presents selected contributions from the “Advanced Research Workshop on Explosives Detection” hosted by the Department of Information Engineering of the University of Florence, Italy in 2018. The main goal of the workshop was to find out how Science for Peace and Security projects in the field of Explosives Detection contribute to the development and/or refinement of scientific and technical knowledge and competencies. The findings of the workshop, presented in the last section of the book, determine future actions and direction of the SPS Programme in the field of explosives detection and management.The NATO Science for Peace and Security (SPS) Programme, promotes dialogue and practical cooperation between NATO member states and partner nations based on scientific research, technological innovation and knowledge exchange. Several initiatives were launched in the field of explosive detection and clearance, as part of NATO’s enhanced role in the international fight against terrorism. Experts and scientists from NATO members and partner countries have been brought together in multi-year projects, within the framework of the SPS Programme, to cooperate in the scientific research in explosive detection field, developing new technologies and methods to be implemented in order to detect explosive substances in different contexts.

Protection of the traveling public from terrorist threats involving explosives is a major goal of the Transportation Security Administration (TSA). For 20 years, the TSA (and the Federal Aviation Administration before it) have been investing in technologies to meet that goal. To support that activity, the TSA has asked the NRC to assess a variety of technological opportunities for offering such protection. The NRC is approaching this assignment by issuing a series of reports on chosen technology applications. This is the first of that series and presents an assessment of mass spectrometry for enhanced trace detection (ETD) of chemicals contained in explosives. The report describes limitations of trace detection in general and the current technologies in particular. It then presents a discussion of the potential for mass spectrometry to improve EDT including challenges faced by such a system, recommendations for starting a program to take advantage of mass spectrometry, and recommendations for a phased implementation plan.

Existing and Potential Standoff Explosives Detection Techniques examines the scientific techniques currently used as the basis for explosives detection and determines whether other techniques might provide promising research avenues with possible pathways to new detection protocols. This report describe the characteristics of explosives, bombs, and their components that are or might be used to provide a signature for exploitation in detection technology; considers scientific techniques for exploiting these characteristics to detect explosives and explosive devices; discusses the potential for integrating such techniques into detection systems that would have sufficient sensitivity without an unacceptable false-positive rate; and proposes areas for research that

might be expected to yield significant advances in practical explosives and bomb detection technology in the near, mid, and long term.

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

Forensic and Environmental Detection of Explosives is the first comprehensive book on the detection of explosives. It combines the two main fields of application: * Forensic detection of explosives - the detection of hidden explosives in airfreight, luggage, vehicles, and on suspects. * Environmental detection of explosives - detecting on-site explosives in soil and water of contaminated areas and the detection of landmines. Dr Jehuda Yinon is a world renowned expert on the analysis of explosives and has served as consulting expert during the Oklahoma bombing trial, where his previous book Modern Methods and Applications in Analysis of Explosives was quoted by both the prosecution and defense experts. This new book complements the author's previous book on the analysis of explosives. It includes the following features: * Classifications of explosives * Explanations of the basic terms related to the detection of explosives * Vapor detection methods * Probing radiation methods * Tagging of explosives * Systems integration and performance testing * Detection of explosives in contaminated areas * Detection of landmines. This book is an ideal reference book for those working in forensic and law enforcement agencies concerned with the detection of hidden explosives, as well as for environmental scientists dealing with explosives decontamination. The book is also recommended as a text book for graduate students in analytical, environmental and forensic science.

The topics discussed at the NATO Advanced Research Workshop “Nanotechnology in the Security Systems" included nanophysics, nanotechnology, nanomaterials, sensors, biosensors security systems, explosive detection. There have been many significant advances in the past two years and some entirely new directions of research are just opening up. Recent advances in nano science have demonstrated that fundamentally new physical phenomena are found when systems are reduced in size with dimensions, comparable to the fundamental microscopic length scales of the investigated material. Recent developments in

nanotechnology and measurement techniques now allow experimental investigation of transport properties of nano devices. This work will be of interest to researchers working in spintronics, molecular electronics and quantum information processing.

This text provides training on the fundamental tools and methodologies used in active forensic laboratories for the complicated analysis of fire debris and explosives evidence. It is intended to serve as a gateway for students and transitioning forensic science or chemistry professionals. The book is divided between the two disciplines of fire debris and explosives, with a final pair of chapters devoted to the interplay between the two disciplines and with other disciplines, such as DNA and fingerprint analysis. It brings together a multi-national group of technical experts, ranging from academic researchers to active practitioners, including members of some of the premier forensic agencies of the world. Readers will gain knowledge of practical methods of analysis and will develop a strong foundation for laboratory work in forensic chemistry. End-of-chapter questions based on relevant topics and real-world data provide a realistic arena for learners to test newly-acquired techniques.

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.

Nuclear quadrupole resonance (NQR) a highly promising new technique for bulk explosives detection: relatively inexpensive, more compact than NMR, but with considerable selectivity. Since the NQR frequency is insensitive to long-range variations in composition, mixing explosives with other materials, such as the plasticizers in plastic explosives, makes no difference. The NQR signal strength varies linearly with the amount of explosive, and is independent of its distribution within the volume monitored. NQR spots explosive types in configurations missed by the X-ray imaging method. But if NQR is so good, why it is not used everywhere? Its main limitation is the low signal-to-noise ratio, particularly with the radio-frequency interference that exists in a field environment, NQR polarization being much weaker than that from an external magnetic field. The distinctive signatures are there, but are difficult to extract from the noise. In addition, the high selectivity is partly a disadvantage, as it is hard to build a multichannel system necessary to cover a wide range of target substances. Moreover, substances fully screened by metallic enclosures, etc. are difficult to detect. A workshop was held at St Petersburg in July 2008 in an attempt to solve these problems and make NQR the universal technique for the detection of bombs regardless of type. This book presents the essentials of the papers given there.

This report assesses the operational performance of explosives-detection equipment and hardened unit-loading devices (HULDs) in airports and compares their operational performance to their laboratory performance, with a focus on improving aviation security.