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Ignition! Rocket Propellant Technology Solid Rocket Propellants The Chemistry and Technology of Solid Rocket Propellants (A Treatise on Solid Propellants) Compatibility of Rocket Propellants with Materials of Construction Solid Rocket Propulsion Technology Calculation of the Specific Impulse of Rocket Propellants Ignition Boron-Based Fuel-Rich Propellant An Experimental Investigation of Chemical Reaction Between Propellant Tank Material and Rocket Fuels Or Oxidizers when Impacted by Small High-velocity Projectiles Encyclopedia of Liquid Fuels Fast Reactions in Energetic Materials Rocket Propellants Rocket Propellants Compatibility of Materials with Rocket Propellants and Oxidizers Rocket Propellants (Chapter 6). Chemical Rockets, and Flame and Explosives Technology Rocket Propellants The Conversion of Liquid Rocket Fuels, Risk Assessment, Technology and Treatment Options for the Conversion of Abandoned Liquid Ballistic Missile Propellants (Fuels and Oxidizers) in Azerbaijan History of Liquid Propellant Rocket Engines Discussion of Rocket Propellants (Selected Parts). The Chemistry of Propellants Modern Engineering for Design of Liquid-Propellant Rocket Engines Solid Propellant Rocket Research Demilitarisation of Munitions Application of Demilitarized Gun and Rocket Propellants in Commercial Explosives Liquid Rockets and Propellants Fundamentals of Solid-propellant Combustion The Analysis of Rocket Propellants Rocket Propulsion Toxicity and Hazards of Beryllium and Rocket Propellants Estimation of Performance Factors for Rocket Propellants Pharmacology and Toxicology of Propellant Fuels Toxicity and Other Hazards of Beryllium and Rocket Propellants Ballistic Missile Series Solid Propellant Rocket Research Method of Determining the Tensile Properties of Solid Rocket Propellants SOLID ROCKET PROPELLANTS. Encyclopedia of Monopropellants Synthetic Directions in New Energetic Materials for Advanced Solid Rocket Propellants

The Chemistry of Propellants is a collection of papers and comments presented at the meeting on “The Chemistry of Propellants , held in Paris, France on June 8-12, 1959, organized by the AGARD Combustion and Propulsion Panel. This book is organized into six parts encompassing 25 chapters that serve as an introduction to the broad and important subject of propellant chemistry and propulsion applications. The first part deals with the sources, availability, and comparative costing of propulsion system. The second and third parts discuss the theoretical, thermodynamic, and experimental aspects of liquid and solid propellants. The fourth part examines the main problems concerning preparation, storage, and use of propellants for ramjet, while the fifth part looks into the factors leading to deposits in jet engines and some of the consequences of their existence. The sixth part covers the advantages of the high energy chemical propellants, including fluorine and hydrogen. Combustion and propulsion scientists and researchers will find this book beneficial. The memorandum summarizes the available information on the compatibility of liquid rocket propellants with prominent materials of construction. Fuels and oxidizers of current interest are discussed. The corrosion data which are presented will apply to storing, handling, and control equipment outside of missiles and to missile components excluding combustion chamber. The compatibility of materials with reaction products in combustion chambers, nozzles, etc., is not considered. Included in the summary are data for many nonmetallic materials. The memorandum is subdivided into sections according to the propellant. Each material of construction is rated for a given medium as belonging to one of four classes, based primarily upon corrosion resistance. Consideration also is given to such factors as catalytic decomposition and sensitivity to impact. The pamphlet is devoted to a semitechnical description of the compositions of rocket propellants, their energy (power) characteristics, and operational properties. This newly reissued debut book in the Rutgers University Press Classics imprint is the story of the search for a rocket propellant which could be trusted to take man into space. This search was a hazardous enterprise carried out by rival labs who worked against the known laws of nature, with no guarantee of success or safety. Acclaimed scientist and sci-fi author John Drury Clark writes with irreverent and eyewitness immediacy about the development of the explosive fuels strong enough to negate the relentless restraints of gravity. The resulting volume is as much a memoir as a work of history, sharing a behind-the-scenes view of an enterprise which eventually took men to the moon, missiles to the planets, and satellites to outer space. A classic work in the history of science, and described as “a good book on rocket stuff...that’s a really fun one” by SpaceX founder Elon Musk, readers will want to get their hands on this influential classic, available for the first time in decades. A modern pedagogical treatment of the latest industry trends in rocket propulsion, developed from the authors' extensive experience in both industry and academia. Students are guided along a step-by-step journey through modern rocket propulsion, beginning with the historical context and an introduction to top-level performance measures, and progressing on to in-depth discussions of the chemical aspects of fluid flow combustion thermochemistry and chemical equilibrium, solid, liquid, and hybrid rocket propellants, mission requirements, and an overview of electric propulsion. With a wealth of homework problems (and a solutions manual for instructors online), real-life case studies and examples throughout, and an appendix detailing key numerical methods and links to additional online resources, this is a must-have guide for senior and first year graduate students looking to gain a thorough understanding of the topic along with practical tools that can be applied in industry. Boron-Based Fuel-Rich Solid Rocket Propellant Technology is a professional book that systematically introduces the latest research progress for boron-based fuel-rich solid propellants. It covers surface modifications, coating and agglomerating techniques, granulation, and characterization of amorphous boron powders, and its application to fuel-rich solid rocket propellants. Technologies for controlling the processing methods and combustion performance of fuel-rich propellants are examined, and the book concludes with a summary of the research progress in boron-based fuel-rich solid propellants and a look forward to the foreseeable development trends of military applications. Liquid propellant rocket engines have propelled all the manned space flights, all the space vehicles flying to the planets or deep space, virtually all satellites, and the majority of medium range or intercontinental range ballistic missiles. A wide range of fuels and oxidizers are mentioned in this discussion of rocket propellants. Heat combustion is compared for carbon, hydrogen, kerosine, ethyl alcohol, hydrazine, and boron as well as the petroleum products Prop. T-1, Prop. TS-2, Prop. T-2, heavy kerosine, and gasoline B-70. Heating capacity and specific thrust are compared for kerosine, alcohol, hydrogen, and hydrazine with combustion in liquid oxygen. Heat of combustion and heating capacity are discussed for Li, C, Mg, Be, and B. Single-component and unitary propellants are defined, propellant feed systems are described, and solid propellants are discussed and compared. Hitherto the disposal of munitions was mostly concerned with obsolete stocks, but the political developments in the states of the former Soviet Union have necessitated the disposal of vast quantities of current and obsolete stocks. Obviously, open burning/open detonation cannot be used on such a large scale, not least for environmental considerations. There are two main technical problems associated with the disposal of munitions on the scale required. First, the materials are not simple wastes or rubbish. Their handling, storage, packaging and transportation are subject to very rigid regulation, and justifiably so, for obvious reasons. Second, they are very valuable goods, for which a high price has been paid by the holding states' economic systems. Mere destruction would mean the irretrievable loss of the value invested. But therein lies the problem. Goods like steel or brass scrap can easily be reclaimed, but hypergols and other rocket fuels (for instance) represent a true chemical challenge, while, under certain conditions, explosives may be diverted to civilian use. This, in summary, is the problem that the present book deals with: the two-pronged attack involving demilitarization and recycling technologies. Encyclopedia of Liquid Fuels contains information on liquid fuels to be used as rocket propellants. In the general subject area of fuels for rocket propellants, there are both liquid fuels and solid fuels in use. Solid fuels serve a dual purpose as binders in solid rocket propellants and are not included in this book. Therefore the title of this book could not be Encyclopedia of Rocket Propellant Fuels, but the title had to be more specific by limiting the scope to liquid fuels. The choice of liquid fuels with their widely varying hydrogen content has a strong infl uence on the specific impulse of rocket propellant combinations. The data from recent animal experiments should prove useful in developing a rational therapy for boron hydride poisoning so that in the future the toxicity of these compounds should not be as great a deterrent to their use as at present. This book contains papers presented at the NATO Advanced Research Workshop titled "Application of Gun and Rocket Propellants in Commercial Explosives". (SST.ARW975981) The workshop was organized in collaboration with codirector Dr. Bronislav V. Matseevich (KNIIM) and held in Krasnoarmeisk,

Moscow Region, Russia, October 18-21, 1999. About 70 participants from 11 different countries took part in the meeting (Russia, Belarus, Czech Republic, Germany, Belgium, China, USA, Spain, Israel, Ukraine and the Netherlands). The workshop was principally the continuation of a previous NATO workshop on Conversion Concepts for Commercial Application and Disposal Technologies of Energetic Systems" held at Moscow, Russia, May 17-19, 1994 in the specific area of the reuse of gun and rocket propellants as ingredients in commercial explosives. Oldrich Machacek Vll ACKNOWLEDGMENTS I would like to thank Dr. B.V. Matseevich, Director of the Krasnoarmeisk Scientific Research Institute of Mechanization ("KNIIM") for his extensive involvement as co-director in organizing the Advanced Research Workshop in Krasnoarmeisk, Russia. Special thanks goes to Dr. V.P. Glinskij, Dr. LV. Vasiljeva and A.I. Fedonina from KNIIM and Dr. B. Vetlicky for invaluable assistance in preparation and the smooth operation ofthe workshop. Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 94. Chapters: Monopropellants, Rocket fuels, Rocket oxidizers, Aluminium, Gunpowder, Boron, Ethanol, Hydrogen peroxide, Ammonium perchlorate, Ammonium nitrate, Nitrous oxide, Hydrazine, Hypergolic propellant, Liquid hydrogen, Unsymmetrical dimethylhydrazine, Dinitrogen tetroxide, Liquid rocket propellants, Propellant depot, Diborane, Chlorine trifluoride, RP-1, Ammonium perchlorate composite propellant, Hydroxylamine, Nitromethane, Triethylaluminium, Mary Sherman Morgan, High-test peroxide, Tetranitromethane, Triethylborane, Pentaborane, Decaborane, Liquid oxygen, Perchloryl fluoride, Nitroethane, Oxygen difluoride, Diethylene glycol dinitrate, Rocket candy, Hydroxylammonium nitrate, Furfuryl alcohol, Monomethylhydrazine, Methylacetylene, Chlorine pentafluoride, Propylene glycol dinitrate, Hydyne, Trinitramide, Guanidine nitrate, Nitronium perchlorate, Hexanitrohexaazaisowurtzitane, Red fuming nitric acid, Nitrous oxide fuel blend, Tetrafluorohydrazine, Trimethylolethane trinitrate, Aerozine 50, Hydroxyl-terminated polybutadiene, Syntin, Ammonium dinitramide, List of stoffs, Diethylenetriamine, T-Stoff, UH 25, C-Stoff, Slush hydrogen, Triethylene glycol dinitrate, Hard start, ALICE, White fuming nitric acid, PBAN, Tonka, Aerotech Consumer Aerospace, Zero-emission rocket propulsion, DMAZ, HNF, Mixed oxides of nitrogen, Z-Stoff, HPGP. Propellants contain considerable chemical energy that can be used in rocket propulsion. Bringing together information on both the theoretical and practical aspects of solid rocket propellants for the first time, this book will find a unique place on the readers' shelf providing the overall picture of solid rocket propulsion technology. Aimed at students, engineers and researchers in the area, the authors have applied their wealth of knowledge regarding formulation, processing and evaluation to provide an up to date and clear text on the subject. Several programs are currently underway at Thiokol Propulsion which strive to meet or exceed the goals of the Integrated High Performance Rocket Propulsion Technology (IHPRPT) Program. The three major program efforts are: the completed Advanced Oxidizers and Fuels Program, in which was synthesized and evaluated a series of new ingredients for solid rocket propellants; the current Hybrid Fuel Program, which will produce fuels that complement the Tactical Hybrid Rocket Engine Applied Technology (THREAT) Program design and proposed advanced oxidizer; and the current Phase III Ingredient Program, which strives to identify novel, high performance, solid propellant ingredients for boost and orbit transfer applications. All three programs have already undergone down-selection from myriad of possible compounds to a much more workable number of candidates for synthetic consideration. This book, a translation of the French title Technologie des Propergols Solides, offers otherwise unavailable information on the subject of solid propellants and their use in rocket propulsion. The fundamentals of rocket propulsion are developed in chapter one and detailed descriptions of concepts are covered in the following chapters. Specific design methods and the theoretical physics underlying them are presented, and finally the industrial production of the propellant itself is explained. The material used in the book has been collected from different countries, as the development of this field has occurred separately due to the classified nature of the subject. Thus the reader not only has an overall picture of solid rocket propulsion technology but a comprehensive view of its different developmental permutations worldwide. The book provides an overview of the rapid development of new propellant concepts, mainly in the area of environmentally-friendly rocket propellants, while at the same time documents the history of what had been done with less sustainable materials in the past. The publication summarizes lessons learned, covering mostly liquid rocket propellants, and helps chemists in developing new energetic materials. Solid Propellant Rocket Research This translation reviews solid, liquid and hybrid rocket propellants, their classification and reactions with fuels and oxidizers, their corrosivity, toxicity and storage stability. Prof. Dr. -Ing. Wolfgang Spyra Brandenburg University of Technology in Cottbus, Germany The demilitarization and conversion of military properties wor- wide has been a topic of growing importance since the end of the Cold War. The slowing of the arms race brought on by weapons treaties and relaxed tensions between NATO and Warsaw Pact nations caused sto- piles of conventional weapons to become superfluous. The need to process and dispose of such weapons began more quickly in NATO countries. This demilitarization process began shortly after the reunification of Germany and was largely completed by the mid to late 1990’s. The remaining process, no small task in itself, of converting lands formerly used by the military into safe and environmentally acceptable landscapes may continue for decades to come. Due to a lack of resources and technology, the process of demilitarization in the former Warsaw Pact countries has launched more slowly. In 2002 both Georgia and Moldova finished projects which destroyed their stocks of liquid ballistic missile components. Both these projects were carried out through the cooperative support of trans-national organizations, private contractors, and research institutions. The Republic of Azerbaijan now finds itself at the beginning of its demilitarization process. Stored at the country’s military depots are over 2000 tons of missile fuels, oxidizer, and chemical additives. This hazardous waste is kept in tanks intended only for temporary transport and storage. Rocket Propulsion has come of age. Although its potentialities and capabilities in many areas have been recognized for centuries, it is only in recent years that scientists have had the materials and the manufacturing techniques at their command so they could control and direct the tremendous forces available. Space exploration and manned flights by astronauts have brought the science of rocketry to the attention of the general public. It has also stimulated the interest of students at all level The book is a treatise on solid propellants in nine chapters, covering the history, chemistry, energetics, processing and characterization aspects of composite solid propellants, internal ballistics, advanced solid propellants, safety, quality and reliability and homogenous or double base propellants. The book also traces the evolution of solid propellant technology in ISRO for launch vehicles and sounding rockets. There is a detailed table of contents, expanded index, glossary, exhaustive references and questions in each chapter. It can be used as a textbook for science and engineering students, as a reference book for researchers and as a companion to scientists and engineers working in the research, development and production areas of solid propellants. Modern energetic materials include explosives, blasting powders, pyrotechnic m- tures and rocket propellants [1, 2]. The study of high-temperature decomposition of condensed phases of propellants and their components (liquid, solid and hybrid) is currently of special importance for the development of space-system engineering [3, 4]. To better understand the burning mechanisms (stationary, nonstationary, - steady) of composite solid propellants and their components, information about the macrokinetics of their high-temperature decomposition is required [5]. To be able to evaluate the ignition parameters and conditions of safe handling of heat-affected explosives, one needs to know the kinetic constants of their high-temperature - composition. The development of new composite solid propellants characterized by high performance characteristics (high burning rates, high thermal stability, stability to intrachamber perturbations, and other aspects) is not possible without quanti- tive data on the high-temperature decomposition of composite solid propellants and their components [6]. The same reasons have resulted in signi?cant theoretical and practical interest in the high-temperature decomposition of components of hybrid propellants. It is known that hybrid propellants have not been used very widely due to the low bu- ing (pyrolysis) rates of the polymer blocks in the combustion chambers of hybrid rocket engines. To increase the burning rates it is necessary to obtain information about their relationships to the corresponding kinetic and thermophysical prop- ties of the fuels.

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