

PREFACE

Significant advances have been made recently in the area of ignition and combustion of energetic materials as well as their commercial applications. These advancements cover experimental, theoretical, and computational areas. Some technological gaps still exist in the combustion of energetic materials. To promote technical communication and to encourage further advancement in this important area, the International Advisory Committee for the Foundation of International Symposium on Special Topics in Chemical Propulsion decided to conduct the Fifth International Symposium (5-ISICP): *Combustion of Energetic Materials* in June of 2000. The 5-ISICP meeting was held in Stresa, Italy, from June 18-22nd, 2000.

The International Symposium had several major objectives. These were: 1) to promote communication between researchers, designers, and manufacturers regarding state-of-the-art approaches in the field of propellants and combustion; 2) to discuss new and improved safety techniques in the combustion of energetic materials; and 3) to recommend future directions for research in combustion and chemical reaction systems. The Symposium also addressed several pressing global issues: a) the resolution of environmental issues in the combustion of energetic materials; b) the need for economical utilization of finite fuel resources; c) the production of power using existing or newly synthesized energetic materials; and d) the development of adequate techniques for disposal of surplus propellants and explosives for demilitarization purposes.

The Symposium was attended by 130 participants, from 19 countries. In total, 156 technical papers were offered, including 86 oral presentations and 67 poster papers. Of these, 90 were selected for publication in this edited book. All papers were reviewed using the same comprehensive procedures employed by respected journals in this field. Therefore, this volume should be considered an edited book of carefully reviewed and selected technical papers, rather than a collection of Symposium proceedings. In this edited book, the accepted papers are grouped into the following twelve technical areas.

Area 1: Reaction Kinetics of Energetic Materials (Solid, Liquid, and Gel Propellants)

Area 2: Recycling of Energetic Materials.

Area 3: Combustion Performance of Hybrid and Solid Rocket Motors.

Area 4: Ignition and Combustion of Energetic Materials.

Area 5: Energetic Material Defects and Rocket Engine Flowfields.

Area 6: Metal Combustion.

Area 7: Pyrolysis and Combustion Processes of New Ingredients and Applications

Area 8: Theoretical Modeling and Numerical Simulation of Combustion Processes of Energetic Materials.

Area 9: Combustion Diagnostic Techniques.

Area 10: Propellant and Rocket Motor Stability.

Area 11: Commercial Applications of Energetic Materials (Airbags, Gas Generators, etc.).

Area 12: Thermal Insulation and Ablation Processes.

Co-sponsorship of the Symposium was provided by the U.S. Office of Naval Research; the U.S. Army Research Laboratory; the European Office of Aerospace Research and Development (EOARD), London, UK; the Office of Naval Research Europe (ONR Europe), London, UK; the U.S. Army Research Development and Standardization Group (USARDSG), London, UK; Société National des Poudres et Explosifs (SNPE), France; Research Academy of China, China; National Tsing Hua University, Taiwan, ROC; The Pennsylvania State University, USA; Politecnico di Milano, Italy; and the University of Maryland, USA. Since the Symposium and the compilation of this edited book would not have been possible without generous financial assistance, the support of these diverse organizations is greatly appreciated.

Major organizational responsibilities for the Symposium were divided between the two of us. We would like to express our sincere gratitude to the following session chairs and co-chairs, for their help in establishing the technical program and planning of the Symposium: Prof. Merrill Beckstead, Dr. Richard Behrens, Dr. Fred Blomshield, Mr. Thomas Boggs, Mr. J. Eric Boyer, Prof. Carlo Buongiorno, Dr. Chester Clark, Prof. Aldo Coghe, Prof. Fred E.C. Culick, Dr. Alain Davenas, Prof. Maurizio DiGiacinto, Prof. Luciano Galfetti, Prof. Alon Gany, Dr. Robert L. Glick, Mr. Albert Horst, Prof. Akira Iwama, Prof. Boris N. Kondrikov, Prof S. Krishnan, Dr. Guy Lengellé, Dr. Alex Mitchell, Dr. Benveniste Natan, Dr. Elaine S. Oran, Dr. Roland Pein, Dr. Arie Peretz, Dr. James Short, Prof. Yaakov M. Timnat, Dr. R.H. Woodward Waesche, Prof. Richard Yetter, Prof. Vladimir E. Zarko, and Prof. Ben T. Zinn.

We would like to thank many international advisory board members and the numerous selected reviewers for technical review of all papers submitted for publication. Their effort has significantly enhanced the quality of many selected papers, which went through some revisions. We would like to acknowledge Dr. Arie Peretz and Dr. Abdullah Ulas for their help in technical editing some portion of the papers during the editorial work period. Ms. Sue Tighe is to be thanked for her dedicated administrative assistance and communication with many paper contributors. A special thanks to Mr. Fred Coppersmith for his great help in the English editing of numerous papers written by authors from non-English speaking countries. Without their help, the publication of this volume would be impossible. We would also like to thank Prof. Luciano Galfetti for assembling the Poster Sessions at Stresa and Mr. Andrea Menalli for substantial help in the general organization of the symposium. Finally, and most importantly, we wish to thank all the authors for

their paper contribution and collaboration in following the format specified by the Begell House publisher.

To promote excellence in technical work, three awards were given at the Symposium. One award is the Martin Summerfield Memorial Best Paper Award, named for Professor Martin Summerfield of Princeton University, who passed away in 1996 and was internationally known as an authority and a great scientist in the field of combustion and propulsion. This award was given to Dr. Richard Behrens of the Sandia National Laboratory for his invited plenary lecture. The other two awards were given to the best oral presentation and best poster presentation papers. These two awards were presented to Dr. Genie G.M. Stoffels of Delft University of Technology and Dr. Antoine E.D.M. van der Heijden of TNO Prins Maurits Laboratory of the Netherlands, respectively.

A complete list of the international advisory committee members with their specialized areas is given at the end of this preface. Their input to the technical program is greatly acknowledged.

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Symposium Co-Chairs and Volume Co-Editors