EASTERN SECTION OF THE COMBUSTION INSTITUTE - 1991 FALL TECHNICAL MEETING

SUNDAY, OCTOBER 13, 1991, 6:30 - 9:00 P.M. -- REGISTRATION

MONDAY, OCTOBER 14, 1991

8:30 a.m.  A. Invited Speaker -- "Progress Towards a Unified View of Energetic Material Hazards," D. M. Mann, Army Research Office, and A.M. Mellor, Vanderbilt University.

Session A - 1 Nonpremixed Flames

Chairperson:  R. L. Axelbaum, Washington University


10:25 a.m.  Coffee Break


11:05 a.m.  5. "Dynamics of an Unsteady Ethylene Jet Diffusion Flame," C.R. Kaplan, Naval Research Laboratory, S.W. Baek, Korea Advanced Institute of Science and Technology, J.L. Elzey, University of Texas, E.S. Oran, Naval Research Laboratory.


11:45 a.m.  Lunch
MONDAY, OCTOBER 14, 1991

8:30 a.m.  A. Invited Speaker -- "Progress Towards a Unified View of Energetic Material Hazards", D. M. Mann, Army Research Office, and A.M. Mellor, Vanderbilt University.

Session B - 1 Explosions and Detonations

Chairperson: R.G. Gann, National Institute of Standards and Technology


10:25 a.m.  Coffee Break


11:25 a.m.  45. "Underwater Explosion Bubbles Calculations," W.C. Strahle, Georgia Institute of Technology.

11:45 a.m.  Lunch

MONDAY, OCTOBER 14, 1991

8:30 a.m.  A. Invited Speaker -- "Progress Towards a Unified View of Energetic Material Hazards", D. M. Mann, Army Research Office, and A.M. Mellor, Vanderbilt University.

Session C - 1 Laser Ignition

Chairperson: K. Brezinsky, Princeton University


10:25 a.m.  Coffee Break


11:25 a.m.  Lunch

11:45 a.m.  Lunch
MONDAY, OCTOBER 14, 1991

1:15 p.m.  B. Invited Speaker -- "Fire Suppression in the Next Century," R.G. Gann, National Institute of Standards and Technology.

2:00 p.m.  The XXIV Symposium, R.W. Bilger, University of Sydney.

Session A - 2 Premixed Flames

Chairperson:  J.A. Miller, Sandia National Laboratories


3:10 p.m.  9. "Application of Continuation Methods to Plane Premixed Laminar Flames," V. Giovangigli, Ecole Polytechnique, M.D. Smooke, Yale University.

3:30 p.m.  Refreshment Break


4:10 p.m.  11. "Modeling the Onset of Negative Temperature Coefficient Behavior in the Oxidation of Hydrocarbon Fuels," R.D. Wilk, Union College.


5:30 p.m.  Adjourn

5:40 p.m.  Executive Committee Meeting

MONDAY, OCTOBER 14, 1991

1:15 p.m.  B. Invited Speaker -- "Fire Suppression in the Next Century," R.G. Gann, National Institute of Standards and Technology.

2:00 p.m.  The XXIV Symposium, R.W. Bilger, University of Sydney.

Session B - 2 Practical Combustion/Incineration

Chairperson:  M. Lavid, Energia, Inc.

2:30 p.m.  46. "Photochemical Conversion of Chlorofluorocarbons and Halons to Useful Compounds of Lower Ozone Depletion Potential," A.T. Poulos, S. Gulati, and M. Lavid, Energia, Inc.


3:30 p.m.  Refreshment Break


5:30 p.m.  Adjourn

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Session C - 2 Compartment Fires

Chairperson: C. L. Beyler, Hughes Associates


3:10 p.m.  86. "Chemical Stability of Upper-Layer Fire Gases," W.M. Pitts, National Institute of Standards and Technology.

3:30 p.m.  Refreshment Break


4:10 p.m.  88. "Modeling Smoke Movement through Compartimented Structures," W.W. Jones and G.P. Forney, National Institute of Standards and Technology.

4:30 p.m.  89. "The Interaction of an Isolated Sprinkler Spray and a Two-Layer Compartment Fire Environment - An Overview," L.Y. Cooper, National Institute of Standards and Technology.

4:50 p.m.  90. "Applications of the Generalized Global Equivalence Ratio Model (GGERM) for Predicting Combustion Products in Transient Room Fire Environments," L.Y. Cooper, National Institute of Standards and Technology.


5:30 p.m.  Adjourn

5:40 p.m.  Executive Committee Meeting

TUESDAY, OCTOBER 15, 1991


Session A - 3 Vortex Interactions with Flames/Turbulent Flames

Chairperson: W. M. Pitts, National Institute of Standards and Technology


10:25 a.m.  Coffee Break

10:45 a.m.  18. "Experiments on Molecular Mixing in the Field of a Vortex," N. Mohamad and B.M. Cetegen, University of Connecticut.


11:45 a.m.  Lunch
TUESDAY, OCTOBER 15, 1991


Session B - 3 Chemical Kinetics of CHC's and Soot
Chairperson:  L. D. Pfefferle, Yale University


10:25 a.m.  Coffee Break

10:45 a.m.  57. "Measurements and Calculations of the Post-Flame Thermal Destruction of CH3Cl," E.M. Fisher, Cornell University, and C.P. Koshland, University of California, Berkeley.


11:45 a.m.  Lunch

TUESDAY, OCTOBER 15, 1991


Session C - 3 Pool Fires/Radiation
Chairperson:  L. Y. Cooper, National Institute of Standards and Technology


9:45 a.m.  93. "Heat Flux to the Fuel Surface of a Pool Fire," M. Klassen, Purdue University, and A. Hamins, National Institute of Standards and Technology, and J. Gore, Purdue University, and T. Kashiwagi, National Institute of Standards and Technology.


10:25 a.m.  Coffee Break


11:45 a.m.  Lunch
TUESDAY, OCTOBER 15, 1991


Session A - 4 Turbulent Flames and Combustion

Chairperson: S. B. Pope, Cornell University


3:30 p.m. Refreshment Break


5:30 p.m. Adjourn

5:40 p.m. General Business Meeting (all members invited)

TUESDAY, OCTOBER 15, 1991


Session B - 4 Chemical Kinetics

Chairperson: S. Hochgreb, Massachusetts Institute of Technology

2:10 p.m. 60. "A Theoretical Analysis of the Reaction Between Hydrogen Atoms and Isocyanic Acid," J.A. Miller and C.F. Melius, Sandia National Laboratories.


3:10 p.m. 63. "Kinetics of CN Reactions with HCN and C2N2," D.L. Yang, T.Yu, and M.C. Lin, Emory University and C.F. Melius, Sandia National Laboratory.

3:30 p.m. Refreshment Break

3:50 p.m. 64. "Theoretical Study of H + HNO Abstraction and Addition Reactions," M.R. Soto and M. Page, Naval Research Laboratory.


5:30 p.m. Adjourn

5:40 p.m. General Business Meeting (all members invited).
TUESDAY, OCTOBER 15, 1991


Session C - 4 Fire Spread

Chairperson: R. A. Altenkirch, Mississippi State University


3:30 p.m. Refreshment Break


5:10 p.m. Adjourn

5:40 p.m. General Business Meeting (all members invited)

WEDNESDAY, OCTOBER 16, 1991


Session A - 5 Diagnostics

Chairperson: T. A. Cool, Cornell University


10:25 Coffee Break

10:45 a.m. 33. "High Temperature Quenching Cross Sections for Nitric Oxide Laser-Induced Fluorescence Measurements," M.C. Drake and J.W. Ratcliffe, General Motors Research Laboratories.


11:45 a.m. Lunch
WEDNESDAY, OCTOBER 16, 1991


Session B - 5 Chemical Kinetics
Chairperson:  E. M. Fisher, Cornell University


10:25 a.m.  Coffee Break


11:45 a.m.  Lunch

WEDNESDAY, OCTOBER 16, 1991


Session C - 5 Droplets and Sprays
Chairperson:  S. C. Yao, Carnegie Mellon University


10:25 Coffee Break


11:45 a.m.  Lunch
WEDNESDAY, OCTOBER 16, 1991

Session A - 6 Diagnostics

Chairperson: K. C. Smyth, National Institute of Standards and Technology


1:35 p.m. 37. "Exciplex-Based Vapor/Liquid Visualization Systems Appropriate for Automotive Gasolines," L.A. Melson, University of Texas at Dallas.


2:55 p.m. Adjourn

Session B - 6 Buoyant Flames

Chairperson: P. Givi, State University of New York at Buffalo


2:35 p.m. Adjourn
PROGRESS TOWARDS A UNIFIED VIEW OF ENERGETIC MATERIAL HAZARDS

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INTRODUCTION

Energetic material is the generic term used to describe the class of compounds and mixtures used as sources of energy for rockets, guns, and a variety of other systems. These materials are characterized by their high density of stored chemical energy. When initiated, the energy is released by chemical reactions. In the case of the class of explosives, the reaction front moves through the material at supersonic velocity with a resultant violent rise in pressure and temperature. In contrast, propellants used for gun and rocket propulsion burn with a subsonic reaction front providing lower rates of pressure and temperature rise. However, there is not a sharp division between explosive and propellant formulations. Some propellants, when subjected to severe stimuli, can be driven to violent reaction and detonation. Clearly, it is necessary to ensure that the energetic materials are not subjected to such stimuli at any time during manufacture, loading into systems, handling and storage of the systems, or the response of the energetic material is to be characterized, and how it can be related to the stimulus.

It is obvious that the response of an energetic material to an external stimulus will be strongly influenced by the material’s physical and chemical properties. Additionally, a host of external variables can affect the response. Primary among these are ambient temperature, relative humidity and the properties of the confinement surrounding the material. An understanding of the interplay of these variables and how they influence the susceptibility to initiation and severity of response of the energetic material is a major objective of government and industry hazards programs.

In the following sections, we review the methods of characterizing the response of energetic materials to stimuli and models relating the stimuli to the initiation of energy release in the materials. The presentation is restricted to initially solid energetic materials, with a primary focus on propellants. The discussion draws heavily upon the material presented at a recent workshop which was held to survey the state of understanding of propellant ignition micro mechanics[1].

ENERGETIC MATERIALS HAZARDS TESTS

At the full scale systems level, the stimuli are, in principle, relatable to the threat to which the system is exposed. However, this is not always straightforward, as a single action, such as a nearby detonation, may produce a variety of potential