

 SAINT-MALO • FRANCE



EURO PYRO

46th IPS SEMINAR • 2023

SEPTEMBER
11-14th
2023

Monday, September 11th

16:00-18:00 **Reception of the delegates at the Palais du Grand Large**

From 18:30 **Welcome reception at the Palais du Grand Large**

Tuesday, September 12th

Auditorium du Grand Large

08:30-09:10 **Opening Ceremony**

09:10-09:30 **Paul Vieille Special Award**

09:30-10:00 **Keynote 1**

Dr Brian FUCHS, Steering Committee Chair, Munitions Safety Information Analysis Center, MSIAC, NATO
Fielding Safe and Effective Munitions in the Current Surge of Demand

10:00-10:30 **Break**

Auditorium du Grand Large

Award Ceremony

10:30-10:55 **IPS Frank Carver Bursary Award**

Kazuki INOUE, Yokohama National University, Japan

Preparation and energetic characterization of azole-oxidizer ionic cocrystals

Co-author(s): M. NAKAMURA¹, K. OKADA², M. KUMASAKI¹, S. MATSUMOTO¹

¹Yokohama National University|²National Institute of Advanced Industrial Science and Technology, Japan

10:55-11:20 **Dr Bernard E. Douda IPS young scientist Award**

Sabrina WAHLER, RoseEnergetic UG, Germany

RoseBoom2.4© ("Research output software for energetic materials based on observational modelling/machine learning")

Co-author: T.M. KLAPÖTKE¹

¹Ludwig-Maximilian University of Munich, Germany

11:20-11:45 **Special AF3P and GTPS french young scientist Award**

Jordan EHRHARDT, French-German Research Institute of Saint-Louis, France

Towards understanding gun propellant decomposition via detailed kinetic modeling

11:45-12:10 **Innovation GTPS Award**

ElixirTM, a new treatment unit for a safe and clean destruction of pyrotechnic material wastes

Thibault DERODE, ArianeGroup SAS, France

Co-authors: A. MONPEZAT, E. ELIAS, A. IGEL

12:10-12:30 **Group Photo**

12:30-14:00 **Lunch**

14:00-18:10 **Session 1: Energetic Materials 1**

Auditorium du Grand Large

Session chairs: Joost van Lingen, TNO, The Netherlands – Didier Poulain, CEA, France

Electrosynthesis of energetic materials

Presenter: PIERCEY Davin

Co-author(s): D. PIERCEY¹

¹ Purdue University, USA

Synthesis of CL-20 by palladium-free and benzylamine free route

Presenter: RAO VEPA Kameswara

Co-author(s): K. RAO VEPA¹, N. KOMMU¹, D. KARIKE¹, A. MUNAF¹, P. ARVIND¹

¹ University of Hyderabad, India

Combustion and mechanical properties of co(glycidyl nitrate-glycidyl azide) polymer energetic binders

Presenter: DUBOIS Charles

Co-author(s): C. DUBOIS¹, R. PONTES¹, J. ST-CHARLES²

¹ Polytechnique Montreal² General Dynamics Ordnance and Tactical Systems, Valleyfield Powder, Canada

Theoretical and practical approach of a new method for chemical compatibility tests applied to pyrotechnic compositions

Presenter: MEDUS Dominique

Co-author(s): D. MEDUS¹, C. SANDRE², A. COME³, K. PATEL⁴, P. SERRANO⁵

¹ LACROIX GROUP² Etienne LACROIX³ ALSETEX⁴ ENERGETICS-Technology Ltd / UK⁵ FALKEN

Performance studies of Glycidyl Azide Polymers coated Aluminium particles

Presenter: KEERTHI Venu

Co-author(s): V. KEERTHI¹, S. PISHARATH¹, H.H. HNG¹

¹ Emerging nanoscience Research Institute, Nanyang Technological University, Singapore

Investigation of morphology-controllable synthesis of CuO and their catalytic efficiency for ammonium perchlorate

Presenter: SHEN Lixiao

Co-author(s): L. SHEN¹, S. ZHU¹, Y. LI¹, L. ZHANG¹, Y. Zhenxin¹, Z. Chenguang¹

¹ Nanjing University of Science and Technology, School of Chemistry and Chemical Engineering, China

Synthesis and characterization of a promising energetic polysaccharide derived from chitosan for potential application in advanced energetic formulations

Presenter: TARCHOUN Ahmed Fouzi

Co-author(s): A.F. TARCHOUN¹, D. TRACHE¹, A. ABDELAZIZ¹, M.A. HAMOUCHE¹, H. BOUKECIAT¹

¹ Ecole Militaire Polytechnique; Algeria

Nitrostarch as a promising insensitive energetic biopolymer: synthesis, characterization, and thermal decomposition kinetics

Presenter: ABDELAZIZ Amir

Co-author(s): A. ABDELAZIZ¹

¹ Energetic Materials Laboratory, Teaching and Research Unit of Energetic Processes, Ecole Militaire Polytechnique, Algiers, Algeria

Formulation, synthesis and characterization of nitroglycerin inclusion compounds

Presenter: COMET Marc

Co-author(s): M. COMET¹, C. SCHWARTZ¹, B. LALLEMAND¹, L. LEMIEGRE², J. AUDIC², D. SPITZER¹

¹ Laboratoire NS3E - UMR 3208 ISL/CNRS/UNISTRA|² ISCR - UMR 6226, Université de Rennes, France

Chemical model to evaluate new HTPB batch: Application to composite propellants tuning

Presenter: REJSEK-RIBA Virginie

Co-author(s): V. REJSEK-RIBA¹

¹ ROXEL France, France

Property Estimation of Energetic Composite Materials

Presenter: JAANSALU Kevin M.

Co-author(s): K.M. JAANSALU¹

¹ Munitions Safety Information Analysis Center, NATO HQ, Brussels, Belgium

14:00-18:10 **Session 2: Pyrotechnics systems**

Salle Grand Large

Session Chairs: Christophe Tamisier, French-German Research Institute of Saint-Louis, France – Bernard Chamayou, ArianeGroup, France

Safety in Production approach applied to pyrotechnics

Presenter: COTTREL-BUSSENAULT Marie

Co-author(s): M. COTTREL-BUSSENAULT¹, S. VERDELET², F. MILCENT³, J. MARTINEZ⁴, M. CHEVALIER⁵, C. GRENOUILLOUX⁶, F. MOTHES⁷, H. DU BARET⁸

¹ Ariane Group SAS, France|² CEA CESTA|³ Naval Group|⁴ MBDA|⁵ Schneider Electric|⁶ SAFRAN E&D|⁷ SECTOR|⁸ DGA MI, France

Laser slapper detonator for shock compression study of energetic materials: free-space and fibered systems

Presenter: HEBERT Philippe

Co-author(s): P. HEBERT¹, J. MORAND¹, S. RIBOULET¹, S. KERAMPAN², M. ARRIGONI²

¹ CEA, DAM, le Ripault |² ENSTA Bretagne, IRDL, CNRS UMR 6027, France

Hydrotrial Initiator Characterisation Trial

Presenter: SCOTT Thomas

Co-author(s): T. SCOTT¹, S. FINNEGAN¹

¹ AWE, United Kingdom

Characterization of Pressure Output in Pyrotechnic Delays

Presenter: MOTYKA Mark

Co-author(s): M. MOTYKA¹

¹ US Army, DEVCOM - Armaments Center, Pyrotechnics Technology Division, USA

A New Pyrotechnic Delay for the 120 mm HE RAP ammunition

Presenter: SABARD Jérémy

Co-author(s): J. SABARD¹, J. MEUNIER¹

¹ Thales LAS France, France

Flyer plate ignition of launcher detonation based functions

Presenter: GLAVIER Ludovic

Co-author(s): L. GLAVIER¹

¹ArianeGroup SAS, France

Adequacy between linear charge dihedral pyrotechnic jetcord choice and mechanical parasitic ruptures in the case of pyrotechnical rings application

Presenter: MAR Modou

Co-author(s): M. MAR¹

¹ArianeGroup SAS, France

Design and set-up of a high-speed isolation valve: application to hypervelocity impacts on hydrazine

Presenter: ABDULHAMID Hakim

Co-author(s): H. ABDULHAMID¹, P. DECONINCK¹, F. PACAUD¹, J. MESPOULET¹

¹THIOT Ingénierie, France

Hybrid Gas Generation for Small Size Applications

Presenter: LE BRETON Gaël

Co-author(s): G. LE BRETON¹

¹Pyroalliance, France

Analytical and numerical approach for the modelling of a leaking high-pressure pyromechanism

Presenter: BRATEAU Marion

Co-author(s): M. BRATEAU¹, S. KERAMPAN², A. BOUCHAMA³, A. CLOUGH¹, M. ARRIGONI²

¹CTAI² ENSTA Bretagne, IRDL, CNRS UMR 6027³ DGA Land Systems, France

Methodology for structural robustness evaluation of hybrid airbag inflator submitted to pyrotechnic pressure wave

Presenter: DAVIOT Nicolas

Co-author(s): N. DAVIOT¹, A. BERTHE¹

¹Autoliv Livbag, France

14:00-18:10 **Session 3: Modeling 1**

Salle Bouvet

Session chairs: Antoine Osmont, CEA, France – Ashwin Chinnayya, ENSMA, France

On the calculation of Chapman-Jouguet states using the STASIS multi-phase thermochemical code

Presenter: PARKER Andrew

Co-author(s): A. PARKER¹

¹Fluid Gravity Engineering Ltd, United Kingdom

CARTE thermochemical code : calculation of detonation properties

Presenter: DUBOIS Vincent

Co-author(s): V. DUBOIS¹, R. SORIN¹

¹CEA, DAM, DIF, France

Maximum likelihood analysis of the James criterion

Presenter: MAISEY MATTHEW

Co-author(s): M. MAISEY¹

¹AWE, United Kingdom

Correlation between gap-test and P-tau criterion applied to the determination of non-detonation

Presenter: ELIA Thomas

Co-author(s): T. ELIA¹, C. FOURTIER¹, J. MORICEAU¹, B. THEVENIN¹, T. GILLOUX¹

¹Thales LAS, France

Assessment of ammunition reaction violence for any mechanical load

Presenter: GATTINI Sébastien

Co-author(s): S. GATTINI¹, G. POIREY¹

¹ArianeGroup SAS, France

Application of machine learning to the design of energetic materials: preliminary experience and comparison with alternative techniques

Presenter: WESPISER Clément

Co-author(s): C. WESPISER¹, D. MATHIEU¹

¹CEA, DAM, le Ripault, France

Experimental measurement of heats of formation of explosives: towards reference cohesive energy data for energetic salts

Presenter: PASQUINET ERIC

Co-author(s): E. PASQUINET¹, L. HABERT¹, D. MATHIEU¹, M. DANIEL¹

¹CEA, DAM, le Ripault, France

Experimental and modeling study of RDX-HTPB gun propellant decomposition

Presenter: EHRHARDT Jordan

Co-author(s): J. EHRHARDT¹, J. GLORIAN¹, B. BASCHUNG¹

¹French-German Research Institute of Saint-Louis, France

Kinetic Analysis of the Thermal Decomposition of Three LOVA Gun Propellants Based on RDX and Nitrocellulose

Presenter: DELBARRE Samuel

Co-author(s): S. DELBARRE¹, L. COURTY¹, M. WILLIAM-LOUIS¹

¹Univ. Orleans, INSA-CVL, PRISME EA 4229, France

Chemical kinetic modeling study of double-base propellant decomposition

Presenter: GLORIAN Julien

Co-author(s): J. GLORIAN¹, J. EHRHARDT¹, B. BASCHUNG¹

¹French-German Research Institute of Saint-Louis (ISL), France

A novel method for improving the reliability of simulation of the behavior of energetic materials based on kinetic analysis

Presenter: RODUIT Bertrand

Co-author(s): B. RODUIT¹, P. FOLLY², A. SARBACH², R. BALTENSPERGER³

¹AKTS SA² armasuisse, Science and Technology Centre, Switzerland³ University of Applied Sciences of Western Switzerland, Switzerland

Wednesday, September 13th

08:30-09:00 **Keynote 2**

The Safety and Performance Characteristics of LLM-105 and its Plastic Bonded Formulations Correlated to Ingredient Properties

Dr GASH Alexander

Deputy Director, Energetic Materials Center, Lawrence Livermore National Laboratory, USA

09:10-10:30 **Session 4: Modeling 2 - Workshop on explosives (Journées détonique CEA)**

Auditorium du Grand Large

Session chairs: Matthew Maisey, AWE, UK – Antoine Osmont, CEA, France

Pressure and temperature dependent thermal conductivity tensor of high explosive crystals

Presenter: PERRIOT Romain

Co-author(s): R. PERRIOT¹

¹ Los Alamos National Laboratory, USA

Towards modeling polycrystalline TATB at extreme conditions: a mesoscale model informed by atomistic simulations

Presenter: LAFOUCARDE Paul

Co-author(s): P. LAFOUCARDE¹, N. BRUZY¹, J. MAILLET¹, C. DENOUAL¹

¹ CEA DAM DIF, Bruyères-le-Châtel et Université Paris-Saclay, LMCE, Bruyères-le-Châtel, France

Influence of microstructure on the Shock Detonation Transition of heterogeneous explosives

Presenter: SAUNIER Jérôme

Co-author(s): J. SAUNIER¹, A. CHINNAYYA², M. GENETIER³, E. KAESHAMMER³

¹ CEA Gramat / Institut Pprime² Institut Pprime ³ CEA Gramat, France

Pore-scale simulations of pop-plot in HMX and HMX-based explosives

Presenter: GALLIER Stany

Co-author(s): S. GALLIER¹

¹ ArianeGroup SAS, France

09:10-10:30 **Session 5: Mechanics**

Salle Grand Large

Session chairs: Philippe Le Helley, ArianeGroup, France – Steven Kerampran, ENSTA Bretagne, France

Multi-scale study of inelastic deformation mechanisms in propellants and plastic bonded explosives

Presenter: BROWN Judith

Co-author(s): J. BROWN¹, J. CLEMMER¹, K. LONG¹

¹ Sandia National Laboratories, USA

Modelling nano-indentation of single crystal beta-HMX.

Presenter: DROUET David

Co-author(s): D. DROUET¹, D. PICART², M. GRATTON¹, A. FRACHON¹, M. CALIEZ¹

¹ Univ. Tours, Univ. Orléans, INSA CVL, LaMé, EA 7494, France | ² CEA, DAM, le Ripault, France

Fatigue of a TATB-based plastic bonded explosive

Presenter: PICART DIDIER

Co-author(s): D. PICART¹, S. MEO², M. VENIN², F. LACROIX², G. BERTON², C. POMPON¹

¹ CEA, DAM, Le Ripault | ² Univ. Tours, Univ. Orléans, INSA CVL, LaMé, EA 7494, France

HVEV: A nonlinear viscoelastic model applied to energetic materials

Presenter: RABETTE François

Co-author(s): F. RABETTE¹, A. VANDENBROUCKE¹, G. POIREY¹, T. VIANT¹

¹ Ariane Group SAS, France

09:10-10:30 **Session 6: Testing facilities**

Salle Bouvet

Session chairs: Alexandre Lefrançois, CEA, France – Yves Guengant, ArianeGroup, France

Design, set-up of a new powder launcher at CEA Gramat and first experiments

Presenter: LE GALLIC Christian

Co-author(s): C. LE GALLIC¹, F. SINATTI¹, S. BOUSSAC², J. MESPOULET²

¹ CEA/Gramat | ² Thiot Ingenierie, France

Study of the development of a new pyrotechnic site for reactive materials investigations

Presenter: PEYRATOUT Maëlle

Co-author(s): M. PEYRATOUT¹, R. RODIER¹, F. PLASSARD¹

¹ Thiot Ingenierie, France

Rail guided bombs: launcher set up, predictive analysis and experimental results

Presenter: PIROTAIS Olivier

Co-author(s): O. PIROTAIS¹

¹ CEA Gramat, France

10:30-11:00 **Break**

11:00-12:40 **Session 7: Co-crystals - Workshop on explosives (Journées détonique CEA)**

Auditorium du Grand Large

Session chairs: Alexander Gash, Lawrence Livermore National Laboratory, USA – Eric Pasquinet, CEA, France

Successful journey in preparation of the energy-safety balanced cocrystals of attractive nitramines via coagglomeration

Presenter: PATIL Veerabhadragouda B.

Co-author(s): V.B. PATIL¹, S. ZEMAN¹

¹ Institute of Energetic Materials, Faculty of Chemical Technology, University of Pardubice, Czech Republic

Detonation Performance and Material Characterization of CL-20 and MDNT Co-crystal Versus Physical Mixture

Presenter: LAWRENCE Joseph

Co-author(s): J. LAWRENCE¹, S. SON¹, M. ÖRNEK¹, D. PATEL¹, R. FERGUSON², S. HAMLIN²

¹ Purdue University² Purdue University, USA

Molecular Dynamic Simulations for Stability Prediction of Energetic Cocrystals

Presenter: POSSEL Clemens

Co-author(s): C. POSSEL¹, M. HERRMANN¹

¹ Fraunhofer Institute for Chemical Technology ICT, Germany

Effect of Preparation Conditions on Cyclic Thermal Behaviors of Some Potassium Nitrate-doped Phase-stabilized Ammonium Nitrates

Presenter: DATE Shingo

Co-author(s): S. DATE¹

¹ National Defense Academy, Japan

Energetic Ionic Cocrystals of Ammonium Nitrate

Presenter: BENNETT Andrew

Co-author(s): A. BENNETT¹, A. MATZGER¹

¹ University of Michigan, USA

11:00-12:40 **Session 8: Fireworks and Decoys**

Salle Grand Large

Session chairs: Dominique Medus, Etienne LACROIX, France – Stephane Besombes, Roxel, France

Infrared-Spectroscopy of the Combustion Flame of Red Phosphorus

Presenter : KOCH¹ Ernst-Christian

¹Lutradyne, Germany

Adiabatic flame temperatures of firework compositions

Presenter: HOBBS Michael

Co-author(s): M. HOBBS¹, H. MOFFAT¹

¹ Sandia National Laboratories, USA

Behavior of millimeter-wave radiation in the flame of Mg-based pyrotechnic composition

Presenter: LI Jingwei

Co-author(s): J. LI¹, C. ZHU¹

¹ Nanjing University of Science and Technology, China

Development of environmentally friendly pyrotechnic colored flame compositions

Presenter: ZEBREGS Martijn

Co-author(s): M. ZEBREGS¹, R. BOUMA¹, J. VAN DEN ELSHOUT¹, J. VAN LINGEN¹

¹TNO, Department of Energetic Materials, The Netherlands

Development of a low-smoke lift system for fireworks shells

Presenter: DEN OTTER Arjan

Co-author(s): A. DEN OTTER¹, M. STRAATHOF¹, M. VAN ROOIJEN¹, C. VAN DER MEER¹, E. KROON¹, J. VAN LINGEN¹

¹TNO, Department of Energetic Materials, The Netherlands

11:00-12:40 **Session 9: Prevention and detection**

Salle Bouvet

Session chairs: Lionel Hairault, CEA, France – Didier Poullain, CEA, France

Phlegmatization of highly sensitive Explosives for the Use in Explosive Detection Dog Training

Presenter: WILHELM Isabel

Co-author(s): I. WILHELM¹

¹ Fraunhofer Institute for Chemical Technology ICT, Germany

Characterization of Homemade Explosives for Aviation Security: The Effect of Material Properties on X-ray Feature Spaces

Presenter: DEPIERO Sabrina

Co-author(s): S. DEPIERO¹, O. ALAWODE¹, I. SEETHO¹, S. GLENN¹, H. MARTZ¹

¹ Lawrence Livermore National Laboratory, USA

Detonation Simulant of Homemade Explosive as Donor Charge for Tertiary Explosives

Presenter: BELMEHDI Djamal

Co-author(s): D. BELMEHDI¹, M.H. LEFEBVRE², M.K. BOULKADID¹, R. VAN RIET²

¹ Ecole Militaire Polytechnique, Algiers, Algeria² Royal Military Academy, Brussels, Belgium

Global HME Precursor Testing Project

Presenter: COLLEY Thomas

Co-author(s): T. COLLEY¹

¹ US Department of Homeland Security, USA

Requirements for post-blast explosive forensics underwater

Presenter: ÖNNERUD Hans

Co-author(s): H. ÖNNERUD¹, H. EDVINSSON², M. JAHAN², M. FJÄLLGREN²

¹ Swedish Defence Research Agency (FOI)² Swedish Defence Research Agency, Sweden

12:30-14:00 **Lunch**

14:00-16:20 **Session 10 : Workshop on explosives (Journées détonique CEA)**

Auditorium du Grand Large

Session chairs: Denis Spitzer, ISL, France – Arnaud Beaucamp, CEA, France

Spray flash evaporation (sfe) and spray flash synthesis (sfs), two continuous versatile processes to formulate and synthesize energetic nano- and submicronized materials with enhanced safety

Presenter: SPITZER Denis

Co-author(s): D. SPITZER¹

¹ NS₃E/ISL, France

Nanoporous Carbon Filled with Oxidizing Agents: an Effective and Pragmatic Approach to Energetic Nanomaterials

Presenter: VAN RIET Romuald

Co-author(s): R. VAN RIET¹, P. MELO BRAVO¹, M.H. LEFEBVRE¹

¹ Royal Military Academy, Brussels, Belgium

Preparation and stabilisation of amorphous energetic materials

Presenter: CHANDWANI CHANDWANI Monica

Co-author(s): M. CHANDWANI CHANDWANI¹

¹ University of Edinburgh, United Kingdom

Modeling the shock-to-detonation transition process in the TATB/HMX composition TX₁ with a reactive burn model based on an implicit viscoplastic pore collapse model

Presenter: BOUTON Eric

Co-author(s): E. BOUTON¹, A. SOLLIER², P. HEBERT¹

¹ CEA, DAM, le Ripault² CEA, DAM, DIF, France

Study on the Influence of microstructure on the Detonation Performance of a TATB-based PBX

Presenter: BOUCHET Thomas

Co-author(s): T. BOUCHET¹, A. BEAUCAMP¹

¹ CEA-DAM Le Ripault, France

The Enhanced Floret Test - Revealing the Surprising Insensitivity of LLM-105 Formulation Corner-Turning Behavior to Density

Presenter: HOBSON-DUPONT Maximilian

Co-author(s): M. HOBSON-DUPONT¹, C. MAY¹, J. THOMPSON¹

¹ Lawrence Livermore National Laboratory, USA

14:00-16:20 **Session 11: Energetic Materials – Additive manufacturing**

Salle Grand Large

Session chairs: Shingo Date, National Defence Agency, Japan – Jean-Francois Guery, ArianeGroup, France

Additive Manufacturing of Energetic Materials at Los Alamos National Laboratory

Presenter: MUELLER Alexander

Co-author(s): A. MUELLER¹, A. SCHMALZER¹, B. TAPPAN¹, D. NAUD¹, C. BROWN¹

¹ Q-5, Los Alamos National Lab, USA

Additive manufacturing of explosives compositions

Presenter: HOLSTEIN AUDREY

Co-author(s): A. HOLSTEIN¹

¹ ArianeGroup SAS, France

Developing Digital Twins of Additive Manufactured Components

Presenter: KLINE Dylan

Co-author(s): D. KLINE¹, M. GRAPES¹, G. EGAN¹, M. HENNESSEY¹, H. SPRINGER¹, R. REEVES¹, K. SULLIVAN¹, J. BELOF¹

¹ Lawrence Livermore National Laboratory, USA

Additive Manufacturing of Dog Bones and Strands of an Ammonium Perchlorate/Thermoplastic Elastomer Propellant

Presenter: BLADHOLM Viktor

Co-author(s): V. BLADHOLM¹

¹ Swedish Defence Research Agency (FOI), Sweden

Probing the role of solids loading and mix procedure on the properties of acoustically mixed materials for additive manufacturing

Presenter: DOORENBOS Zac

Co-author(s): Z. DOORENBOS¹, D. KLINE¹, M. GRAPES¹, E. AVALOS¹, C. LANDEROS¹, P. MARTINEZ¹, R. REEVES¹, K. SULLIVAN¹

¹ Lawrence Livermore National Laboratory, USA

Optimization model and analysis of screw extrusion 3D printing process parameters for propellants

Presenter: WANG Moru

Co-author(s): M. Wang¹, G. Jin¹, W. He¹, F. Nan¹, X. Lin¹

¹ Nanjing University of Science and Technology, China

14:00-16:20 **Session 12: Testing**

Salle Bouvet

Session chairs: Eric Welle, Air Force Research Laboratory, USA – Serge Bordachar, DGA, France

IM Signature of Aged Munitions

Presenter: COLLET Christelle

Co-author(s): C. COLLET¹

¹ MSIAC, Brussels, Belgium

TNT early reaction in shock Equation of State determinations

Presenter: LEFRANCOIS Alexandre

Co-author(s): A. LEFRANCOIS¹, J. MAPAS¹, V. CHUZEVILLE¹, M. GENETIER¹, R. BOULANGER², H. AUBERT³

¹ CEA Gramat² Nexter Munitions, France³ CNRS LAAS, France

Factors influencing ESD tests for pyrotechnic compositions

Presenter: PELIKAN Vojtech

Co-author(s): V. PELIKAN¹, P. HREBICKOVA¹

¹ Institute of Energetic Materials, Faculty of Chemical Technology, University of Pardubice, Czech Republic

Blast effects of an underwater explosion: a small-scale approach using high-speed imaging

Presenter: TRELAT Sophie

Co-author(s): S. TRELAT¹, M. STURTZER², P. LEGRAND¹, S. HEMMERLIN²

¹ IRSN (Institut de Radioprotection et de Sûreté Nucléaire)² French-German Research Institute of Saint-Louis (ISL), France

Effects of explosive charges in contact with steel plates: small-scale experimental investigation using high-speed imaging

Presenter: STURTZER Michel

Co-author(s): M. STURTZER¹, S. TRELAT²

¹ ISL² IRSN (Institut de Radioprotection et de Sûreté Nucléaire), France

Acceleration ability of oxidizer-containing cast cured aluminized explosives

Presenter: YANG Kun

Co-author(s): K. YANG¹, L. CHEN¹, D. LIU¹, K. ZHANG¹, J. LIU¹, J. WU¹

¹ Beijing Institute of Technology, Beijing, China

17:30 **Visit in Saint-Malo**

19:30 **Gala Dinner at Palais du Grand Large**

Thursday, September 14th

08:30-09:00 **Keynote 3**

Metal combustion

Prof. HALTER Fabien

Institut de Combustion Aérodynamique Réactivité et Environnement (ICARE), Orleans University, France

09:10-10:30 **Session 13: Combustion 1**

Auditorium du Grand Large

Session chairs: Fabien Halter, ICARE, France – Carole Rossi, CNRS-LAAS, France

Reaction Mechanisms In Powdered Thermites

Presenter: SULLIVAN Kyle

Co-author(s): K. SULLIVAN¹

¹ Lawrence Livermore National Laboratory, USA

Toward a computational tool to simulate for the combustion of thermites powders

Presenter: GLAVIER Ludovic

Co-author(s): L. GLAVIER¹, E. TICHCHENKO¹, C. ROSSI²

¹ ArianeGroup SAS, France | ² CNRS LAAS, France

Multilinear analysis of influential parameters on the combustion velocity of ternary pyrotechnic compositions

Presenter: ROSÈRES Charles

Co-author(s): C. ROSÈRES¹, C. BOULNOIS², L. COURTY³

¹ INERIS | ² Nexter Munitions, France | ³ Université d'Orléans, France

Investigation of the catalytic effects of mono/bimetallic organic framework derivatives on ammonium perchlorate

Presenter: YAN Li

Co-author(s): L. YAN¹, L. DONGZE¹, L. SHEN¹, Y. Zhenxin¹, Z. YI¹, L. ZHANG¹, S. ZHU¹, Z. CHENGUANG¹

¹ Nanjing University of Science and Technology, School of Chemistry and Chemical Engineering, China

09:10-10:30 **Session 14: Energetic materials 2**

Salle Grand Large

Session chairs: Christophe Coulouarn, Thales, France – Loic Minguet, Euroco, France

Insensitive High Explosive Qualification of LLM-105 Based Explosive

Presenter: HERNANDEZ Patricia

Co-author(s): P. HERNANDEZ¹

¹ Lawrence Livermore National Laboratory, Defense Technologies Engineering Division, USA

To predict energetic material critical diameter

Presenter: POIREY Gilles

Co-author(s): G. POIREY¹, S. GATTINI¹

¹ ArianeGroup SAS, France

Effect of the initiation point on the blast generated by a high explosive cylinder of varying shape

Presenter: OSMONT Antoine

Co-author(s): A. OSMONT¹, A. LEFRANCOIS², M. GENETIER²

¹ CEA/DAM² CEA Gramat, France

Anisotropic Detonation to shape directional effects

Presenter: ASCHEHOUG Laure

Co-author(s): L. ASCHEHOUG¹, L. BODARD¹, B. NOUGUEZ¹

¹ EURENCO – FR, France

09:00-10:30 **Session 15: Environment**

Salle Bouvet

Session chairs: Volker Weiser, Fraunhofer Institute for Chemical Technology ICT, Germany – Stephane Besombes, Roxel, France

Feasibility of next-generation colored smoke compositions with reduced toxicity

Presenter: POINTART Céline

Co-author(s): C. POINTART¹, A. GUERIN², D. MEDUS¹, A. COME³, H. FEDOU², N. PERRIER⁴, C. LE GALLIOT⁴, S. RONA-BEAULIEU⁴, J.L. PAQUIE⁵

¹ Etienne LACROIX² DGA Techniques Terrestres, France³ ALSETEX⁴ DGA, France⁵ Etienne LACROIX, France

Development of an in vitro method to assess the cytotoxic effect of pyrotechnic smoke compositions

Presenter: ASHRIN Aya

Co-author(s): A. ASHRIN¹, E. ANNA¹, M. FLOREANI¹, D. MEDUS², C. POINTART², G. FAYET¹, P. ROTUREAU¹, G. LACROIX¹

¹ INERIS² Etienne LACROIX, France

Effect of temperature and atmosphere on NOx emissions during incineration of waste energetic materials

Presenter: JIN Guorui

Co-author(s): S. Wang¹, M. Wang¹, X. Liao¹, W. He¹

¹ Nanjing University of Science and Technology, China

Underwater demilitarization: a safe and efficient way to eliminate solid propellant

Presenter: BOUTEILLE/MERIEL Frédéric/Laurent

Co-author(s): F. BOUTEILLE/MERIEL¹

¹ ROXEL France, France

10:30-11:00 **Break**

11:00-12:40 **Session 16: Combustion 2**

Auditorium du Grand Large

Session chairs: Stany Gallier, ArianeGroup, France – Fabien Halter, ICARE, France

Silicon - a established pyrotechnic fuel as zero-charbon, high-density energy storage

Presenter: WEISER Volker

Co-author(s): V. WEISER¹, S. KELZENBERG¹, S. KNAPP¹

¹ Fraunhofer Institute for Chemical Technology ICT, Germany

Janus Type Hypergolic Fuels for Hybrid Propulsion

Presenter: GOZIN Michael

Co-author(s): M. GOZIN¹, N. PETRUTIK², I. KAMINKER², E. FLAXER³, D. SHEM-TOV², J. DAS²

¹Tel Aviv University²School of Chemistry, Faculty of Exact Sciences, Tel Aviv University, Israel³Afeka, Tel-Aviv Academic College of Engineering, Israel

Measurement of the temperature of burning aluminum particles using multi-spectral pyrometry

Presenter: GLASZIOU Valentin

Co-author(s): V. GLASZIOU¹, F. HALTER², C. CHAUVEAU², S. COURTIAUD³

¹CEA-Gramat & CNRS-ICARE²CNRS-ICARE³CEA Gramat, France

Aluminum combustion: from detonation to blast effects

Presenter: ARNAUD Nicolas

Co-author(s): N. ARNAUD¹, A. HOLSTEIN¹, S. GATTINI¹

¹ArianeGroup SAS, France

Impact Sensitivity Estimation of Pure Energetic Materials

Presenter: OSMONT Antoine

Co-author(s): A. OSMONT¹, A. DEMENAY², L. CATOIRE², N. DESGARDIN³, G. JACOB³

¹CEA/DAM²ENSTA Paris³Ariane Group SAS, France

11:00-12:40 **Session 17: Energetic Materials 3**

Salle Grand Large

Session chairs: Loic Minguet, Eurenco, France – Christophe Tamisier, French-German Research Institute of Saint-Louis, France

Self-Healing Cast Cured Energetic Materials

Presenter: ECK Genevieve

Co-author(s): D. DRU¹, R. CHARMET¹, G. ECK¹, T. ALAIME¹, B. NOUGUEZ¹, R. BAATI², R. AVILA ROVELO²

¹EURENCO - FR²ICPEES, France

The reaction kinetic handling of complex reaction behaviour in solid composite rocket propellants cured with aziridine type agents

Presenter: BOHN Manfred A.

Co-author(s): M.A. BOHN¹, G.S. TUSSIWAND²

¹Fraunhofer ICT²HAPTICA s.r.l., Italy

New manufacturing process of energetic materials by Resonant Acoustic Mixing (RAM) - From lab to fab

Presenter: PEROUEL JULIE

Co-author(s): J. PEROUEL¹, C. DEBIESSE¹, S. CUVELIER¹

¹ EURENCO, France

New low cost melt-cast composition for IM mortar ammunition – Theoretical approach to experimental aspect

Presenter: GILLOUX Teddy

Co-author(s): T. GILLOUX¹, C. COULOUARN¹

¹ THALES, France

Use of soluble desensitizer to pilot terminal performance and IM response for a TNT based melt-cast composition

Presenter: GILLOUX Teddy

Co-author(s): T. GILLOUX¹, C. COULOUARN¹

¹ THALES, France

11:00-12:40 [GTPS Workshop](#)

[Salle Bouvet](#)

12:40-14:00 **Lunch**

14:00-16:00 **Session 18: Combustion 3**

Auditorium du Grand Large

Session chairs: Ashwin Chinnayya, ENSMA, France – Alexandra Junqua-Moulet, CEA, France

Experiment and Numerical Study on Near-field Underwater Explosion of Aluminized Explosive

Presenter: SUN Yuanxiang

Co-author(s): Y. SUN¹, Y. CHEN¹

¹ State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, China

Thermal performance of gelled thermobaric explosives based on isopropyl nitrate and reactive metal powders

Presenter: BAJIC Danica

Co-author(s): D. BAJIC¹, M. TIMOTIJEVIC¹, M. KRSTOVIC¹, B. FIDANOVSKI¹, J. MOJSILOVIC¹, D. KNEZEVIC¹, J. BOGDANOV¹

¹ University of Defense, Military Academy, Belgrade, Serbia

Graphene Oxide as a Hybrid Oxidizing Additive for B/PTFE Composites

Presenter: QUEK Sebastian Yongsan

Co-author(s): S.Y. QUEK¹, K.Y.G. CHOI¹, S. PISHARATH¹, H.H. HNG¹

¹ Emerging nanoscience Research Institute, Nanyang Technological University, Singapore

Design methodology for UneXploded Ordnance (UXO) protection structures in pyrotechnical depollution: illustration with a 155mm round and a 1000lbs GP bomb

Presenter: MESPOULET Jérôme

Co-author(s): J. MESPOULET¹, J. MESPOULET¹, F. PLASSARD¹

¹Thiot Ingenierie, France

Experimental and numerical methodologies to characterize base-bleed operation in internal ballistics conditions

Presenter: GAILLARD Thomas

Co-author(s): T. GAILLARD¹, R. DEVILLERS¹, R. DEMARTHON², S. HEDDADJ², H. LE BOURSICAUD², J. SCHWARTZ³, J. LESTRADE⁴, C. GRIGNON³, N. TEYSSIER³

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14:00-16:00 **Session 19: Reactivity**

Salle Grand Large

Session chairs: Arnaud Beaucamp, CEA, France – Matthew Maisey, AWE, UK

Rationalisation and Prediction of the Impact Sensitivity of Dinitramide Salts Based on Analysis of Intermolecular Interactions

Presenter: AKACHAI Khumsri

Co-author(s): K. AKACHAI¹, C.R. PULHAM¹, C.A. MORRISON¹

¹ University of Edinburgh, United Kingdom

Modeling the decomposition of energetic materials and their sensitivity

Presenter: GLORIAN Julien

Co-author(s): J. GLORIAN¹, D. MATHIEU², R. CLAVEAU²

¹ French-German Research Institute of Saint-Louis (ISL)² CEA, DAM, le Ripault, France

Analytical study of the HERMES ignition parameter under idealised conditions

Presenter: SCHOFIELD Adam

Co-author(s): A. SCHOFIELD¹, J. CURTIS¹

¹ AWE, United Kingdom

Low-velocity impact and damage of a pressed high explosive

Presenter: HAMON Emilien

Co-author(s): E. HAMON¹, D. PICART¹, P. BAILLY², M. CALIEZ², A. FRACHON², M. GRATTON²

¹ CEA, DAM, le Ripault² Univ. Tours, Univ. Orléans, INSA CVL, LaMé, EA 7494, France

From pyrotechnic compositions to SARS-COV-2 virucidal disinfection; a (nice) ride with NOx

Presenter: ANDRES Didier

Co-author(s): D. ANDRES¹

¹ PYRAGRIC, France

14:00-16:00 **Session 20: Safety**

Salle Bouvet

Session chairs: Yves Guengant, ArianeGroup, France – Christophe Coulouarn, Thales, France

Integrated Safety System Design for a Detonation Physics Laboratory

Presenter: WELLE Eric

Co-author(s): E. WELLE¹, M. MEADOWS¹, L. MARTINEZ¹

¹ Air Force Research Laboratory - Munitions Directorate, USA

Investigation on the dual use of thermal insulation materials as blast mitigation solution

Presenter: DROUET David

Co-author(s): D. DROUET¹, G. PRODHOMME², J. HANUS³, L. BLANC⁴, S. KERAMPAN⁵, J. LE CLANCHE⁵, M. ARRIGONI⁵

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Designing a multicellular pyrotechnic facility against detonation – An actual case study

Presenter: CHAMPASSITH Anousone

Co-author(s): A. CHAMPASSITH¹, E. HENRI², S. BODARD³

¹Technip Energies|²DGA|³EURENCO, France

Development of a non propagating container for A6 ESR neutralization

Presenter: CLANCIER Ludovic

Co-author(s): L. CLANCIER¹

¹ArianeGroup SAS, France

Blast wave mitigation by liquid foams

Presenter: REINDERS Aymerick

Co-author(s): A. REINDERS¹, J. LE CLANCHE¹, M. ARRIGONI¹, Y. GRÉGOIRE², M. MONLOUBOU¹, S.

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16:00-16:30 **Closing Ceremony**



Posters

A study of the Glycidyl Azide Polymer curing systems using triazole and urethane crosslinked networks

Presenter: PALUSSIÈRE Ségolène

Co-author(s): S. PALUSSIÈRE¹, L. GARAGNON¹, M. NAVARRO¹, F. SER¹

¹ ONERA, France

Tests of colored smoke in an instrumented box

Presenter: GUERIN Aurelie

Co-author(s): A. GUERIN¹

¹ DGA Land Systems, France

The Activation Energy of Hexanitrostilbene (HNS-IV) and the Study of Thermal Characteristics of HNS-IV with Accelerated Aging

Presenter: KAMAL Hazal

Co-author(s): H. KAMAL¹, N.E. DINCERYILMAZ¹, B. DUMANLILAR TABAK¹, K. AYDINCAK¹

¹ Roketsan Inc., Turkey

Resonant acoustic mixing applied to energetic material

Presenter: DAVID-QUILLOT Frank

Co-author(s): F. DAVID-QUILLOT¹, M. PION¹, A. DAMERVALLE¹, C. AMBARD¹, D. POUILLAIN¹

¹ CEA-DAM Le Ripault, France

Study of pressing procedures of pyrotechnic heating composition

Presenter: LOPES Ana

Co-author(s): A. LOPES¹, S. GAULTER¹, R. VRCELJ¹

¹ Cranfield University, United Kingdom

Use of a Microcalorimeter to Evaluate Thermally Sensitive Energetic Materials

Presenter: MENDENHALL Ivan

Co-author(s): I. MENDENHALL¹, R. SMITH¹

¹ Autoliv, USA

Experimental Investigation of the Influence of Shock Tube Parameters on Reaction Propagation

Presenter: KUNA Petr

Co-author(s): P. KUNA¹, V. PELIKAN¹, B. JANOVSKY¹

¹ University of Pardubice, Czech Republic

Sampling of automotive airbag inflator gas effluents during discrete periods of the inflator function

Presenter: CARVER Paul

Co-author(s): P. CARVER¹

¹ Autoliv Livbag, USA

Effect of Nano Barium Oxide on Thermal decomposition properties and chemical stability of nitrocellulose

Presenter: TOUIDJINE Sabri

Co-author(s): S. TOUIDJINE¹, M.K. BOULKADID¹, D. TRACHE²

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² Energetic Materials Laboratory, Ecole Militaire Polytechnique, Algeria

A Combined Model for the Pinch and Shearing of an Explosive

Presenter: CURTIS John

Co-author(s): J. CURTIS¹, C. ELLCOME¹

¹AWE Aldermaston, United Kingdom

THALES R&T capacities dedicated to future ammunition

Presenter: COULOUARN Christophe

Co-author(s): C. COULOUARN¹

¹THALES LAS France

Measurement and Quantitative Evaluation of muzzle Flame

Presenter: ZHU Chenguang

Co-author(s): C. ZHU¹

¹Nanjing University of Science and Technology, Jiangsu Province, China

Fast cook-off simulations and comparison with experiments

Presenter: ELIA Thomas

Co-author(s): T. ELIA¹, J. MORICEAU¹, B. THEVENIN¹, C. MARIN¹, M. PAUTTARD¹

¹Thales LAS FRANCE

Laser breakdown as an alternative to study blast waves at the lab scale

Presenter: LE CLANCHE Julien

Co-author(s): J. LE CLANCHE¹, L. VASTIER², R. NIMIHAL², M. MONLOUBOU², S. KERAMPRAN², M. ARRIGONI²

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Some achievements in the synthesis of primary EMs

Presenter: LATYPOV Nikolaj

Co-author(s): N. LATYPOV¹

¹Ian em consulting ab, Sweden

MICA NG dual pulse rocket motor: on the way for a MURAT * label

Presenter: BONHOMME Laurent

Co-author(s): L. BONHOMME¹

¹ROXEL France

Simulation of confined high explosive ignition under low velocity impact

Presenter: CAMUS Stéphanie

Co-author(s): S. CAMUS¹, D. PICART¹

¹CEA DAM Le Ripault, France

Erosion model

Presenter: TIXIER Laurent

Co-author(s): L. TIXIER¹, A. ZINGRAFF¹, J. FOUQUE¹

¹ROXEL France

A methodology to optimise base bleed grain designs

Presenter: BODARD Sébastien

Co-author(s): S. BODARD¹, M. ORAZI¹

¹EURENCO, France

Assembly by fiber laser technology

Presenter: DOUAIS Christophe

Co-author(s): C. DOUAIS¹, E. MORLET¹

¹ ROXEL France

An analytical model for the pinch of an unconfined hollow explosive cylinder

Presenter: ELLCOME Charlie

Co-author(s): C. ELLCOME¹, J. CURTIS¹

¹ AWE, United Kingdom

Effect of pyrotechnical compositions on deflagration to detonation transition development in pentaerythritol tetranitrate

Presenter: SAZECEK FILIP

Co-author(s): F. SAZECEK¹, V. PELIKAN¹, J. PACHMAN¹

¹ Institute of Energetic Materials Faculty of Chemical Technology, University of Pardubice, Czech Republic

Assessment of ternary pyrotechnic compositions thermal conductivities using binary and multi-scale model

Presenter: ROSÈRES Charles

Co-author(s): C. ROSÈRES¹, L. COURTY², C. BOULNOIS³, P. GILLARD²

¹ Ineris² Université d'Orléans³ Nexter Munitions, France

Prediction of the enthalpy of formation of energetic materials by density functional theory calculations

Presenter: OMLOR Andreas

Co-author(s): A. OMLOR¹, M.A. BOHN¹, J. LANG¹

¹ Fraunhofer Institute for Chemical Technology ICT

SIMULATION FOR ENERGETIC MATERIALS Using Inert Crystalline Materials as a Simulation for Energetic Materials

Presenter: MINTOFF Alice

Co-author(s): A. MINTOFF¹

¹ Cranfield University, United Kingdom

Performances and Detonability of Urea-Hydrogen Peroxide (UHP)

Presenter: HALLEUX Francis

Co-author(s): F. HALLEUX¹, D. BELMEHDI², M.K. BOULKADID², M.H. LEFEBVRE¹, R. VAN RIET¹

¹ Royal Military Academy, Brussels, Belgium² Ecole Militaire Polytechnique, Algiers, Algeria

Experimental evidence of shock wave measurements with low-velocity (<100 m/s) and fast dynamics (<10 ns) capabilities using an innovative coupled PDV and triature VISAR diagnostic

Presenter: CHEVALIER Jean-Marc

Co-author(s): J. CHEVALIER¹, G. BOUTOUX¹

¹ CEA/CESTA, France

Study of the ageing of phlegmatized Nitrocellulose in storage conditions and its sensitivity toward shock wave

Presenter: PESSINA Florent

Co-author(s): F. PESSINA¹, N. APCHIN¹, J. RASSON¹, G. FAYET¹

¹ INERIS, France

Development and architecture of opto-pyrotechnical initiators

Presenter: MERLINGE Nicolas

Co-author(s): N. MERLINGE¹, A. VACHER¹, M. PETRANTONI¹

¹ NEXTER Munitions, France

A first approach of the use of laser-driven flyers for shock initiation of explosives: flyer acceleration

Presenter: MORAND Julie

Co-author(s): J. MORAND^{1,2}, M. ARRIGONI², P. HEBERT¹, S. KERAMPRAN²

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