

|                                       |      |
|---------------------------------------|------|
| Preface .....                         | viii |
| Advertisement: <i>MSM Group</i> ..... | 1    |
| Advertisement: <i>Biazzi SA</i> ..... | 2    |

## Presentations

|                                                                                                                                                                                                                                                                           |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Recent developments of energetic di- and trisubstituted cubanes<br><i>Andreas Bartonek, Thomas M. Klapötke, Burkhard Krumm</i> .....                                                                                                                                      | 4  |
| Mitigating environmental impact of TNT production: Strategies for red water reduction and treatment<br><i>Lukas Bauer, Thomas M. Klapötke, Jörg Stierstorfer</i> .....                                                                                                    | 10 |
| LLM-105: achieving different morphologies for different properties<br><i>Arnaud Beaucamp, Thomas Bouchet, Alice Damervalle, David-Quillot Frank, Alexandre Forzy, Eric Pasquinet, Didier Picart, Nicolas Pin, Christophe Pompon, Stéphane Quéré, Anne Wuillaume</i> ..... | 19 |
| Synthesis and evaluation of novel TATB-inspired energetic materials<br><i>Meghan C. Benda, Christopher J. Snyder, David E. Chavez</i> .....                                                                                                                               | 25 |
| BKNO <sub>3</sub> pyrotechnic igniters for SRM: analysis of performance dispersion from development to production<br><i>Barbara Betti, Giulia Pella, Marco Fiorillo</i> .....                                                                                             | 30 |
| Modelling complex ageing behavior of tensile modulus in CTPB-bonded propellant – parametric and kinetically based procedures<br><i>Manfred A. Bohn, Giuseppe S. Tussiwand</i> .....                                                                                       | 38 |
| Energetic polymers derived from oxetanes<br><i>Natasha H. Boulton, Carole A. Morrison, Christopher Murray, Colin R. Pulham</i> .....                                                                                                                                      | 63 |
| Isocyanate-free energetic polymer binders<br><i>Thomas Bugnand, Michel Bouquey, Frédérick Lacemon, Isabelle Dulac</i> .....                                                                                                                                               | 69 |
| Energy output of HMX-based aluminized explosives with varying aluminum (Al) and polytetrafluoroethylene (PTFE) ratios<br><i>Wei Cao, Wei Dai, Yaofeng Mao, Jun Wang, Qin Liu, Wei Guo, Yong Han</i> .....                                                                 | 77 |
| Aluminized highly energetic materials simulation under partial chemical equilibrium assumption with HEMSIm<br><i>Yuri Caridi, Jakub Selesovsky, Andrea Cucuzzella, Jiri Pachman, Stefano Berrone</i> .....                                                                | 87 |
| Thermal isolation modeling of aluminized energetic materials for low-cost computational code<br><i>Andrea Cucuzzella, Yuri Caridi, Stefano Berrone</i> .....                                                                                                              | 95 |

|                                                                                                                                                                                               |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Construction of a composite surface coating layer with high efficiency on desensitization of HMX<br><i>Shuyi Duan, Qing Zhu, Shangbin Li</i> .....                                            | 101 |
| Synthesis and characterisation of the energetic plasticiser Bu-AENA<br><i>Stefan Ek, Marita Sjöblom, Mona Brantlind, Jonas Johansson</i> .....                                                | 109 |
| An overview of vibration effects on energetic materials<br><i>Maurício Ferrapontoff Lemos, Priscila Simões Teixeira Amaral, Moritz Heil, Manfred A. Bohn</i>                                  | 118 |
| A synthetic route to 3,5-dinitropyridine analogs and evaluation of their thermal properties<br><i>Leidy Hooker, Matthew Hamilton, Jack Davis, Christopher J. Snyder</i> .....                 | 125 |
| New green solvents for high dissolution and the mechanism of strongly hydrogen-bonded explosives<br><i>Jianbo Chen, Siqi Zhuang, Yang Jia, Yu Liu</i> .....                                   | 131 |
| An improved statistical analysis of 72 sensitivity datasets<br><i>Dennis Christensen, Antoine van der Heijden, Geir Petter Novik</i> .....                                                    | 137 |
| Optimization of fiber optic probe for measuring detonation velocity<br><i>Stepan Jirman, Dominik Sedlacek, Jiri Pachman</i> .....                                                             | 147 |
| Triazol polymer, first step for a self-healing PBX<br><i>Frédéric Lacemon, Genevieve Eck, Thibaud Alaime, Rachid Baati, Ricardo Avila Rovel, M. R. Nimmakayala</i> .....                      | 157 |
| Research on material model and parameters of metal thin plate under close-in explosion load<br><i>Xing-long Li, Sha Yang, Qi Dong, Liu-cheng Zhang, Rong-xi Hu, Jia-he Feng, Zhong-hua Lu</i> | 163 |
| Exploring complex potential energy landscapes of computationally modelled ballistic modifiers<br><i>Harvey J. Newman, Colin R. Pulham, Carole A. Morrison</i> .....                           | 174 |
| PETN under pressure<br><i>Heather M. Quayle, Qi Feng Chan, Xiaojiao Liu, Colin R. Pulham, Carole A. Morrison</i> .....                                                                        | 181 |
| Some issues of hydroxyl derivatives of ferrocene as modifiers of the combustion rate of composite propellants<br><i>Tomasz Sałaciński, Wiesław Pucko</i> .....                                | 187 |
| Long term decomposition and crystallisation kinetics of ADN under some crystallographic aspects<br><i>Peter Schultz, Claudia Seidel, Michael Herrmann, Thomas Heintz</i> .....                | 194 |
| Towards purifying polyvinyl nitrate<br><i>Stephen Spice, Monica Chandwani, Edmund Morris, Patrick McMaster, Carole A. Morrison, Colin R. Pulham</i> .....                                     | 199 |
| Novel explosive method for the synthesis of silver nanoparticles<br><i>Jan Maurycy Uszko, Robert Matyáš, Steve J. Eichhorn, Avinash J. Patil, Simon R. Hall</i> .....                         | 203 |

|                                                                                                                                                                                               |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Comparing thermal and chemical analysis of aged and unaged NC-based propellants<br><i>Reinier de Vries, E. L. M. la Haye</i> .....                                                            | 210 |
| Reinvestigation of alkali and alkaline earth metal styphnate salts as components for<br>priming compositions<br><i>Shouei Yiu, Marcus Lommel, Jörg Stierstorfer, Thomas M. Klapötke</i> ..... | 217 |
| Advertisement: <i>OZM Research</i> .....                                                                                                                                                      | 222 |
| Advertisement: <i>Austin Powder, Inc.</i> .....                                                                                                                                               | 224 |

## Posters

|                                                                                                                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Measuring powder flow parameters of inert simulants for 3D printing explosives<br><i>Rashed Aldhaferi, Rebecca Millar, Ranko Vrcelj</i> .....                                                                                                                   | 226 |
| The effect of graphene oxide (GO) on the bulk crystallization of ammonium nitrate<br><i>Fatema Alhosani, Ranko Vrcelj</i> .....                                                                                                                                 | 235 |
| Replacement of RDX by TKX-50 in a plastic bonded explosive based on Viton A<br><i>Amr Ali Helmy, Thomas M. Klapötke, Ahmed Elbeih</i> .....                                                                                                                     | 244 |
| Hazard evaluation of nitrocellulose synthesized from okara (soy bean-curd refuse) as a<br>raw material<br><i>Keiji Aritomi, Eiko Higashi, Ken Okada, Katsumi Katoh</i> .....                                                                                    | 251 |
| Enhancing the rheological and processing properties of PBX explosives containing boron<br>through surface modifications and compatibilization with the binder<br><i>Danica Bajić, Ivan Dimitrijević, Mirjana Krstović, Bojana Fidanovski, Zoran Bajić</i> ..... | 255 |
| Effects of the explosion-generated plasma on the ammunition shell<br><i>Zoran Bajić, Petar Radovanović, Branislav Jovanović, Jovica Bogdanov</i> .....                                                                                                          | 265 |
| Effect of 3D printed shaped charge liner on the effectiveness of shaped charges<br><i>Michal Bilina, Martin Vitek, Tomáš Dražan, Pavel Skalický</i> .....                                                                                                       | 271 |
| Research on TNT equivalence of different PBX with aluminium and magnesium<br><i>Jovica Bogdanov, Danica Bajić, Radoslav Sirovatka, Mirjana Krstović,<br/>Mladen Timotijević, Zoran Bajić</i> .....                                                              | 278 |
| Thermal characterization of CHNO-oxidizer TNEF<br><i>Manfred A. Bohn, Jasmin T. Lechner, Moritz Heil, Thomas M. Klapötke</i> .....                                                                                                                              | 283 |
| Numerical study regarding the functioning of solid rocket motor using 3d printed grain<br><i>Andrei-Mihai Braic, Liviu-Cristian Matache, Adrian Rotariu, Dana A.-A. Pîrvoi</i> .....                                                                            | 296 |
| Study on performance and safety characteristics of multilayer composite propellants<br><i>Ioana-Alexandra Dan, Florin-Marian Dîrloman, Adrian Rotariu, Liviu-Cristian Matache,<br/>Traian Rotariu</i> .....                                                     | 302 |
| Synthesis and evaluation of HEDOs in propellant formulations<br><i>Alain Dejeaifve, Romuland Van Riet, Rowan Dobson</i> .....                                                                                                                                   | 311 |

|                                                                                                                                                                                                                                         |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Synthesis and characterization of 1-hydroxy-5-methyltetrazole and its energetic salts<br><i>Lukas J. Eberhardt, Maximilian Benz, Jörg Stierstorfer, Thomas M. Klapötke</i>                                                              | 317 |
| Numerical and experimental analysis of Semtex 1A blast wave parameters<br><i>Romain Fosse, Dominik Sedlacek, Jiri Pachman</i>                                                                                                           | 326 |
| Rocket motor insulation – different fillers and their effect on rheological behavior and internal structure<br><i>Daniel Fromm, Sebastian Rest, Klaus Peter Zeyer, Thomas M. Klapötke</i>                                               | 335 |
| Lead oxide(II, IV) replacement in gasless pyrotechnic time delay compositions<br><i>Marcin Gerlich, Waldemar Trzciński, Marcin Hara</i>                                                                                                 | 338 |
| Synthesis and characterization of novel transition metal coordination compounds of 5-(3,5-dinitro-1H-pyrazol-4-yl)-1H-tetrazole<br><i>William J. Greenwood, Peter Portius</i>                                                           | 347 |
| Strategies for treating explosives-contaminated wastewater: addressing the environmental and health challenges of yellow, pink and especially red water<br><i>Jennifer Heidrich, Lukas Bauer, Thomas M. Klapötke, Jörg Stierstorfer</i> | 358 |
| Surface structures of HMX crystals investigated by means of confocal and atomic force microscopy<br><i>Michael Herrmann, Hubert Weyrauch</i>                                                                                            | 366 |
| LOVA propellants based on RDX and GAP energetic plasticizers - Part 2<br><i>Dorin Holeoleo, Traian Rotariu, Florin-Marian Dîrloman, Adrian Rotariu, Aurel Diacon, Bogdan Pulpea</i>                                                     | 373 |
| Comparative analysis of the ESD sensitivity of B/KNO <sub>3</sub> and B <sub>4</sub> C/KNO <sub>3</sub> pyrotechnic compositions<br><i>Pavčina Hřebíčková, Danillo V.F. Cantini, Vojtěch Pelikán, Jiri Pachman</i>                      | 380 |
| Thermal decomposition behavior of nitrocellulose in the presence of nitric acid solution<br><i>Daito Kinjo, Yuka Furuno, Eiko Higashi, Takahiro Tamba, Ken Okada, Katsumi Katoh</i>                                                     | 388 |
| Investigation of reaction propagation in commercially available shock tubes<br><i>Matěj Kreisl, Petr Kuna, Vojtěch Pelikán, Břetislav Janovský</i>                                                                                      | 393 |
| Calorimetric bomb test as a method for the selection of optimal boron powder for pyrotechnic applications<br><i>Mirjana Krstović, Jelena Petković-Cvetković, Ivan Dimitrijević, Aleksandar Ćitić, Danica Bajić</i>                      | 403 |
| Effect of copper tube quality on the cylinder expansion test results<br><i>Martin Künzel, Jindrich Kucera, Jiri Pachman</i>                                                                                                             | 412 |
| OPTIMEX: Optimization of a simple plane wave generator<br><i>Martin Künzel, Jindrich Kucera</i>                                                                                                                                         | 418 |
| Microwave synthesis of triethylene glycol diazide (TEGDA): Advanced approaches and characterization<br><i>Jasmin T. Lechner, Thomas B. Keicher</i>                                                                                      | 426 |

|                                                                                                                                                                                                                                           |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Characterizing the decomposition and hydrate stability of sodium 5,5'-azotetrazolate<br><i>Jakub Mikuláščík, Adam Votýpka, Miroslav Labaj, Jiří Nesveda, Zdeněk Jalový,<br/>Zuzana Zmrhalová, Libor Červenka, Robert Matyáš</i> .....     | 431 |
| Molecular simulation of reaction mechanisms and transition states<br><i>Andreas Omlor, Manfred A. Bohn</i> .....                                                                                                                          | 439 |
| Study on the influence of material properties and explosive quantities on the formation<br>of Explosively Formed Projectiles (EFP)<br><i>Ioana-Doriana Păcurar, Liviu-Cristian Matache, Dana A.-A. Pîrvoi, Constantin-Cristinel Puică</i> | 445 |
| The danger related to the use of ammunition and explosives<br><i>Judyta Rećko</i> .....                                                                                                                                                   | 454 |
| Comparative analysis and charge modeling using additive manufacturing in explosive<br>breaching<br><i>Martin Sedláček, Michal Bilina, Jiří Procházka</i> .....                                                                            | 462 |
| New smoke formulations based on copper (II) phthalocyanine<br><i>Alexander Schweiger, Thomas M. Klapötke</i> .....                                                                                                                        | 469 |
| Measurement of a single fragment's velocity by using a controlled fragmentation method<br><i>Masahiro Tagawa, Nozomi Takahashi, Reiko Hiyoshi</i> .....                                                                                   | 477 |
| IEM research labs at the start to safety 2.0<br><i>Michal Vitík, Miloš Ferjenčík</i> .....                                                                                                                                                | 484 |
| Selective synthesis of energetic acrylates using microreaction technology<br><i>Heinrich Wegner, Alexander Mendl, Dušan Bošković, Uwe Schaller</i> .....                                                                                  | 492 |
| Synthesis and characterisation of the novel energetic triazenide: PPN<br>bis(1-methyl-3-nitro-1,2,4-triazol-5-yl)triazenide<br><i>Bradley Westwater, Peter Portius</i> .....                                                              | 498 |
| The desulfurization of high nitrogen heterocycles<br><i>Jake Zuckerman, Davin Piercey</i> .....                                                                                                                                           | 507 |
| The synthesis and characterization of energetic materials containing both a tetrazole and<br>a strained ring moiety<br><i>Jake Zuckerman, Davin Piercey</i> .....                                                                         | 511 |
| Advertisement: <i>Nicolet CZ</i> .....                                                                                                                                                                                                    | 517 |
| Advertisement: <i>Explosia</i> .....                                                                                                                                                                                                      | 518 |
| Keyword Index .....                                                                                                                                                                                                                       | 520 |
| Author Index .....                                                                                                                                                                                                                        | 522 |
| Advertisement: <i>Astotec Pyrotechnic Solutions</i> .....                                                                                                                                                                                 | 524 |
| Advertisement: <i>STV Group</i> .....                                                                                                                                                                                                     | 526 |