Energetic Materials
Synthesis, Processing, Performance
Karlsruhe City Plan
How to find the venue

Karlsruhe is located 120 km south of Frankfurt (Main)/Frankfurt International Airport just beside the Autobahn A5, and is also connected to Frankfurt via the Intercity Express Train ICE.

Additional airports are:
Strasbourg (F) (approx. 100 km) and Stuttgart (D) (approx. 90 km)

Congress Center Karlsruhe
Festplatz 9
76137 Karlsruhe
Germany
Energetic Materials – Synthesis, Processing, Performance

The research and development of new energetic materials and formulations for ammunitions, propellants and pyrotechnics is an ongoing process worldwide. Energetic materials must meet a variety of requirements, some of which may be contradictory. Requirements relate primarily to the performance, but insensitivity, stability and vulnerability also play an important role. However, new perspectives have recently emerged in this field. Increasing awareness of the risks that toxic compounds pose to humans and the environment has led to the banning of hazardous materials, and stimulated the search for non-critical substitute components. Other new perspectives include synthesis and processing methods that are environmentally friendly or give access to new materials such as co-crystals, nanocomposites, energetic ionic liquids and 3D energetic metal–organic frameworks. The new energetic ingredients, and advanced production technologies such as the additive manufacturing of energetic materials, may lead to new, innovative applications and the enhanced performance of existing products.

The 49th International Annual Conference of the Fraunhofer ICT will welcome contributions relating to new energetic materials, non-hazardous synthesis and processing techniques, particle technology, binders and bonding agents, formulations and characterization. In addition, associated applications in propellants, high explosives and pyrotechnics will be highlighted.

The objective of the 49th International Annual Conference of the Fraunhofer ICT will be knowledge exchange on basic research, technical implementation, political requirements and industrial use, in order to promote the forward-looking development, production and application of energetic materials related to defense technology, pyrotechnic devices and space propulsion.

Chairman of the Conference
Dr. Uwe Schaller
Fraunhofer ICT, Pfinztal, Germany
REGISTRATION

Please return the enclosed registration form or register online: www.ict.fraunhofer.de/jata2018

Registration fees (incl. proceedings, coffee breaks, lunch), depending on arrival of the registration at the ICT:

- Registration up to June 8th: € 990,-- (incl. 19% VAT)
- Registration up to June 18th: € 1,250,-- (incl. 19% VAT)

Participation cannot be guaranteed for registrations arriving after June 18th, 2018.

The fee must be paid upon receipt of the invoice by bank transfer to the account given on the invoice.

CANCELLATION POLICY

€ 600.-- will be charged for cancellations after June 18th, 2018. No-shows will be charged the whole fee.

ACCOMMODATION

Online: www.ict.fraunhofer.de/accommodation2018

CONFERENCE OFFICE

Foyer of the GARTENHALLE. Open from Tuesday, June 26, 16.00 h till Friday, June 29, 14.30 h during the Conference and may be reached by

Phone +49-(0)7 21/ 37 20 – 60 00

CHECK IN/WELCOME RECEPTION

Please check in at the Conference Office on Tuesday, June 26, between 16.00 and 20.00 h. All participants are cordially invited to the Welcome Reception on the same day, starting at 18.00 h in the foyer of the GARTENHALLE.

CONFERENCE LANGUAGE

English

GET-TOGETHER AND VISIT OF THE INSTITUTE

The Fraunhofer ICT can be visited on Thursday, June 28 in the evening. There will be several short tours of the Institute, accompanied by a Get-together Party with draught beer, barbecue and fireworks (after sunset). Please mark on your registration form whether you wish to participate.

EXHIBITING COMPANIES

AlzChem Trostberg GmbH
Trostberg, D

INGTEC Technik AG
Magden, CH

Kistler Instrumente GmbH
Sindelfingen, D
Tuesday, June 26

18.00 – 20.00 Welcome Reception
Foyer of the GARTENHALLE

Wednesday, June 27

9.00 Welcome Address and Opening

1st Session – ENERGETIC SYSTEMS AND EXPLOSIVES
Chair: J. Campos
University of Coimbra, PT

9.20 V1 A STRATEGIC RESEARCH AGENDA FOR THE AMMUNITION TECHNOLOGIES AREA
H. Östmark, C. Eldsäter
FOI, Stockholm, SE
W. de Klerk, A. van der Heijden
TNO Defence, Safety and Security, Rijswijk, NL

9.40 V2 NEED AND METHODS FOR SURVEILLANCE OF DIFFERENT TYPES OF AMMUNITION
W. de Klerk
TNO Defence, Safety and Security, Rijswijk, NL

10.00 V3 NITROGUANIDINE (NQ) – AN UNDERESTIMATED INSENSITIVE HIGH EXPLOSIVE
NEW INSIGHTS TO SENSITIVENESS AND PERFORMANCE
E.-C. Koch
Lutradyn – Energetic Materials Science & Technology Consulting, Kaiserslautern, D

10.20 V4 REACH TREATMENT OF PYROTECHNICS INITIATORS FOR SPACE APPLICATIONS
M. Palladino
ESA, F
B. Martin, P. Joanny
Dassault, Saint Cloud, F
D. Dilhan
CNES, Paris, F
M. Wolf, T. Maier
ArianeGroup GmbH, D

10.40 Coffee Break
### 2nd Session – EXPLOSIVES AND DETONATION
Chair: S. Wilker  
BAAINBw, Koblenz, D

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<td>DEVELOPMENT OF NANO-TATB AND COMPARISON OF DETONATION SPREADING WITH PRESSED ULTRA-FINE TATB</td>
<td>J.D. Olles, R.R. Wixom, R. Knepper, C. Yarrington</td>
<td>Sandia National Laboratories, Albuquerque, USA</td>
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<td>R. Patel, V. Stepanov</td>
<td>US Army RDECOMUS-ARDEC, Wharton, USA</td>
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<td>11.30</td>
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<td>HYBRID ENERGETIC NANOCOMPOSITES: GREEN DETONATING COMPOUNDS FOR REPLACING LEAD-BASED PRIMARY EXPLOSIVES</td>
<td>M. Comet, C. Martin, F. Schnell, D. Spitzer</td>
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<td>11.50</td>
<td>V7</td>
<td>OPTICAL FIBER METROLOGY FOR DETONATION AND SHOCK TRANSMISSION MEASUREMENTS</td>
<td>J. Quaresma, R. Mendes, J. Campos</td>
<td>LEDAP/ADAI, Coimbra, PT</td>
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<td>L. Deimling, T. Keicher</td>
<td>Fraunhofer ICT, Pfinztal, D</td>
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<td>12.10</td>
<td>V8</td>
<td>MIXTURES OF TATP WITH OXIDIZING COMPONENTS: EXPLOSIVE AND THERMAL PROPERTIES</td>
<td>L. Jeunieau, M.H. Lefebvre</td>
<td>Royal Military Academy, Brussels, B</td>
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### 3rd Session – SYNTHESIS / NEW MATERIALS
Chair: G. Jacob  
Ariane Group, F

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<td>SYNTHESIS AND CHARACTERIZATION OF ENERGETIC COORDINATION COMPOUNDS AS NEW PRIMARY EXPLOSIVES BASED ON 2-SUBSTITUTED TETRAZOLES</td>
<td>N. Szimhardt, M.H.H. Wurzenberger, T.M. Klapötke, J. Stierstorfer</td>
<td>University of Munich (LMU), München, D</td>
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<td>14.20</td>
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<td>HIGH-PERFORMING AND THERMALLY STABLE ENERGETIC (E)-1,2-bis(3,4-DIAMINO-1,2,4-TRIAZOL-5-yl)-ETHENE DERIVATIVES</td>
<td>Qing Ma, Ya Chen, Longyu Liao, Huanchang Lu, Guijuan Fan, Jinglun Huang</td>
<td>Institute of Chemical Materials CAEP, Mianyang, PRC</td>
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<td>INTERNAL PLASTICIZED GA-POLYETHERS FOR SOLID PROPELLANT BINDERS</td>
<td>S. Hafner, T. Keicher Fraunhofer ICT, Pfinztal, D</td>
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<td>T.M. Klapötke LMU, München, D</td>
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<td>SYNTHESIS AND APPLICATIONS OF ENERGETIC MOFS</td>
<td>Hui Su, Jichuan Zhang, Yao Du, Feipeng Lu, Shenghua Li, Siping Pang</td>
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<td>Beijing Institute of Technology, Beijing, PRC</td>
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<td>HIGH-PERFORMANCE ENERGETIC MATERIALS BASED ON BIFUNCTIONALIZED FURAZAN WITH NITRAMINO AND DINITROMETHYL GROUP</td>
<td>Haifeng Huang, Xiaoqiang Li, Hui Li, Jun Yang Shanghai Institute of Organic Chemistry, Shanghai, PRC</td>
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<td>15.40</td>
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<td>Coffee Break</td>
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<td>16.00-18.00</td>
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<td>Live Stream Football World Cup: Germany – South Korea</td>
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**Thursday, June 28**

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<td>A NEW ALGORITHM TO DETERMINE GEOMETRIC PROPERTIES OF PROPELLANT GRAINS FROM COMPUTER TOMOGRAPHIC IMAGING</td>
<td>S. Wurster Fraunhofer ICT, Pfinztal, D</td>
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<td>COMPUTATIONAL CHEMICAL CALCULATION OF THE HEAT OF EXPLOSION OF ENERGETIC MATERIALS</td>
<td>J. Glorian, K.-T. Han, S. Braun, B. Baschung ISL, Saint-Louis, F</td>
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<td>09.40</td>
<td>V16</td>
<td>DEVELOPMENT OF A METHOD FOR CALCULATING THE DETONATION VELOCITY OF INDIVIDUAL EXPLOSIVES AND ITS APPLICATION FOR EXPLOSIVE MIXTURES WITH A HIGH CONTENT OF INORGANIC OXIDANTS AND METALLIC COMBUSTIBLES</td>
<td>A. Smirnov, S. Smirnov Bakhirev State Scientific Research Institute of Mechanical Engineering, Dzerzhinsk, RUS M. Kuklya University of Maryland, USA</td>
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10.00  V17  THE BIG BANG THEORY: TOWARDS PREDICTING IMPACT SENSITIVITY OF ENERGETIC MATERIALS
A.A.L. Michalchuk, C.R. Pulham, C.A. Morrison
University of Edinburgh, GB

10.20  V18  COMPLEMENTARY USE OF HIGH-LEVEL AB INITIO CALCULATIONS AND THERMAL ANALYSIS TO DISCLOSE THERMAL BEHAVIOR OF ENERGETIC TETRANITROACETIMIDIC ACID
N.V. Muravyev, V.G. Kiselev, K.A. Monogarov, A.N. Pivkina
Semenov Institute of Chemical Physics RAS, Moscow, RUS
A.F. Asachenko
Topchiev Institute of Petrochemical Synthesis RAS, Moscow, RUS
I.V. Fomenkov
Zelinsky Institute of Organic Chemistry RAS, Moscow, RUS

10.40  Coffee Break

11.10  POSTER SESSION
Chair: R. Doherty
University of Maryland, USA

12.30  Lunch Break

5th Session – CHARACTERIZATION I
Chair: W. de Klerk
TNO, Rijswijk, NL

14.00  V19  CHARACTERIZATION OF GLASSY NITRAMINES
R. Patel, V. Stepanov, M. Doukkali
US Army, Picatinny Arsenal, USA

14.20  V20  DETERMINATION OF TIME TO IGNITION OF SLOW COOKOFF BY ADVANCED KINETIC ELABORATION OF HEAT FLOW DATA
B. Roduit, R. Zufferey, M. Hartmann
AKTS AG, Siders, CH
P. Folly, A. Sarbach
armasuisse, Thun, CH

14.40  V21  A STUDY ON THE RELIABILITY OF PERFORMANCE MEASUREMENT ACCORDING TO EXPERIMENTAL CONDITIONS IN A CLOSED BOMB TEST
Hyeonju Yu, Seung-Gyo Jang
Agency for Defense Development, Daejeon, ROK
Dasom Kim
Hanwha Research Institute of Technology, Daejeon, ROK

15.00  V22  THERMAL CHARACTERIZATION OF NATURALLY AGED GUN AND ROCKET PROPELLANTS
M. Heil
Fraunhofer ICT, Pfinztal, D
15.20  V23  MICROSTRUCTURE AND THERMAL BEHAVIOR OF ADN-PRILLS INVESTIGATED BY MEANS OF X-RAY DIFFRACTION
M. Herrmann, U. Förter-Barth, H. Fietzek, P.B. Kempa, T. Heintz
Fraunhofer ICT, Pfinztal, D

15.40  Coffee Break

6th Session – CHARACTERIZATION II
Chair: C. Eldsäter
FOI, Tumba, SE

16.00  V24  HIGH RESOLUTION RAMAN SPECTROSCOPIES: NEW CHARACTERISATION METHODS DEVELOPED TO INVESTIGATE THE STRUCTURE OF NANOMETRIC ENERGETIC FORMULATIONS
D. Spitzer, J. Hübner
ISL, Saint-Louis, F

16.20  V25  SYNTHESIS AND PROPERTIES OF ENERGETIC HNS CO-CRYSTALS REGULARLY CONSTRUCTED BY H-BONDING, π-π STACKING AND VAN DER WAALS INTERACTIONS
Yu Liu, Shiliang Huang, Shichun Li, Jinjiang Xu, Jinshan Li
Institute of Chemical Materials CAEP, Mianyang, PRC
Zeshan Wang
Nanjing University of Science and Technology, Nanjing, PRC

16.40  V26  THERMAL CONDUCTIVITY ENHANCEMENT FOR POLYMER BASED ENERGETIC COMPOSITES WITH AN ALTERNATING MICROLAYERED NETWORK STRUCTURE
Guansong He, Jiahui Liu, Zhijian Yang
Institute of Chemical Materials CAEP, Mianyang, PRC

17.00 – 17.30  Coffee / Refreshments

17.30  Bus Departure from Conference Hall to Fraunhofer ICT

18.00  approx. 18.30  Get-together Barbecue Party
Guided Tours of Fraunhofer ICT

22.30  Fireworks

Bus transfer to hotels, Karlsruhe City and Main Station will be available (starting 19.00 h) during the whole evening.

We would like to thank ZINK-Feuerwerk GmbH, D-74389 Cleebronn, for sponsoring the fireworks.
## Friday, June 29

### 7th Session – PROCESSING

**Chair:** R.L. Simpson  
Lawrence Livermore National Laboratory, USA

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<td>OPTIMISATION OF SLURRY COATING PROCESS TO MANUFACTURE PBX USING A DESIGN OF EXPERIMENT APPROACH</td>
<td>P. Bolton, A. Contini, R. Cox, M. Hopkins Till, C. Kalha</td>
<td>AWE, Aldermaston, GB</td>
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<td>9.20</td>
<td>RESONANT, IN-CASE MIXING OF A POLYMER-BONDED EXPLOSIVE SHAPED CHARGE</td>
<td>J.M. Wilgeroth, R. Davey, A. Burn</td>
<td>BAE Systems Land, Glascoed Usk, GB</td>
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<td>09.40</td>
<td>AN AMMONIUM DINITRAME (ADN) CRYCOSRYSTAL: A PROMISING PROPELLANT OXIDIZER WITH DECREASED HYDROSCOPICITY</td>
<td>Zang-Wei Yang, Hao-Jing Wang, Yuan Ma, Fu-De Nie, Hong-Zhen Li</td>
<td>Institute of Chemical Materials CAEP, Mianyang, PRC</td>
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<td>10.00</td>
<td>DEAGGLOMERATION AND COATING OF AL NANOPARTICLES</td>
<td>A. Vorozhtsov</td>
<td>Tomsk State University, Tomsk, RUS / Institute of Problems in Chemical and Energetic Technologies, Byisk, RUS</td>
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<td>N. Rodkevich, E. Glazkova, A. Pervikov, M. Lerner</td>
<td>Institute of Strength Physics and Materials Science of Siberian Branch RAS, Tomsk, RUS</td>
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<td>10.20</td>
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### 8th Session – PROPELLANTS

**Chair:** S. Wurster  
Fraunhofer ICT, Pfinztal, D

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<td>BOROHYDRIDE-RICH ANION BASED ENERGETIC IONIC LIQUIDS AS HYPERGOLDIC FUELS</td>
<td>Wenquan Zhang</td>
<td>Institute of Chemical Materials CAEP, Mianyang, PRC</td>
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11.50  V32  LASER IGNITION OF NON-SOLVENT IONIC LIQUID BASED ON HIGH ENERGETIC SALTS WITH TWO TYPES LASER FOR THRUSTER
N. Itouyama
The University of Tokyo, Tokyo, JAP
H. Habu
Japan Aerospace Exploration Agency ISAS/JAXA, Sagamihara Kanagawa, JAP

12.10  V33  GELLED PROPELLANTS UNDER THERMAL LOAD: A FIRST INSIGHT INTO DECOMPOSITION PHENOMENA
D. Freudenmann, M. Bühler, C. Kirchberger, H. Ciezki, S. Schlechtriem
DLR Institute of Space Propulsion Lampoldshausen, Hardthausen, D

12.30  V34  TWO-STEP REACTION PROCESS FOR SYNTHESIS HYDROXYL-TERMINATED POLY(BUTADIENE)-BASED POLYURETHANE AS COMPOSITE PROPELLANT BINDER
S. Brzic, M. Dimic, M. Bogosavljevic, J. Nesic
Military Technical Institute, Belgrade, SRB

12.50  V35  BURNING BEHAVIOUR OF ADN SOLID PROPELLANTS IN COMPARISON TO OTHER OXIDIZERS
A. Imiolek, V. Weiser, F. Locatelli, C. Tagliabue, V. Gettwert, D. Bieroth
Fraunhofer ICT, Pfinztal, D

13.10  V36  INNOVATIVE NITROGEN-DOPED BORON PROPELLANTS
T. Manning, K. Klingaman, M. Fair, R. Field, R. Crownover, J. Bolognini, V. Panchal, E. Rozumov
US Army RDECOM ARDEC, Picatinny Arsenal, USA
P. Matter
Ohio State University, USA

13.30  Closing Remarks

13.40  Lunch
Posters will be presented during the whole conference. A special Poster Session will take place on Thursday, June 28, 11.10 – 12.30 h. During this time authors should be present for discussion at their posters in the foyer of the Conference Hall.

P37  COMPATIBILITY TESTING OF NITROCELLULOSE WITH ORGANIC STABILIZERS
D. Trache, A. Fouzi Tarchoun
Ecole Militaire Polytechnique, Algiers, ALG

P38  EFFECT OF ORGANIC STABILIZERS’ EUTECTIC MIXTURES ON NITROCELLULOSE STABILITY
S. Chelouche, D. Trache, A. Fouzi Tarchoun, K. Khimeche, A. Mezroua
Ecole Militaire Polytechnique, Algiers, ALG

P39  RHEOLOGICAL BEHAVIORS OF PROPELLANT BINDER IN EXTRUSION PROCESSING ASSISTED WITH SUPERCritical CARBON DIOXIDE
Yajun Ding, Hao Liang, Shiyong Li, Sanjiu Ying, Zhongliang Xiao
Nanjing University of Science and Technology, Nanjing, PRC

P40  PREPARATION AND PROPERTIES OF MIXED NITRATES PROPELLANT MODIFIED BY CELLULOSE NANOFIBERS
Hao Liang, Yong Xia, Shiyong Li, Yajun Ding, Weidong He, Zhongliang Xiao
Nanjing University of Science and Technology, Nanjing, PRC

P 41  BURNING PERFORMANCES OF MICROCELLULAR PROPELLANTS COATED BY POLYMER DETERRENT
Shiyong Li, Hao Liang, Yajun Ding, Wenlong Wu, Sanjiu Ying, Zhongliang Xiao
Nanjing University of Science and Technology, Nanjing, PRC

P 42  STUDYING THE AGING BEHAVIOR OF SELECTED BASE BLEED FORMULATIONS
E.M. Youssef, A. Abdelgawad
Technical Research Center (TRC), Cairo, EGY
H.E. Mostafa
Military Technical College (MTC), Cairo, EGY

P 43  ADVANCED ANALYSIS TECHNIQUES FOR MONITORING AGED DOUBLE BASE PROPELLANTS
A. Abdelgawad, E.M. Youssef
Technical Research Center (TRC), Cairo, EGY
H.E. Mostafa
Military Technical College (MTC), Cairo, EGY

P 44  TEMPERATURE AND TIME DEPENDENT DIFFUSION CONSTANTS OF PROPELLANT GK 5030
M. Kaiser, T. Barski, T. Hagedorn, C. Bäumker
WTD 91, Meppen, D
P 45 PRIMARY EXPLOSIVE ANALYSIS BY NMR QUANTITATIVE DETERMINATION OF SALTS OF TRINITRORESORCINE AND 4,6-BENZOFUROXAN
M. Kaiser, T. Hagedorn
WTD 91, Meppen, D

P 46 NANOCRYSTALLIZATION OF AMMONIUM DINITRAMIDE (ADN) BY SPRAY FLASH EVAPORATION (SFE)
J.-E. Berthe, D. Spitzer
ISL, Saint-Louis, F

P 47 MAGNESIUM RICH PYROTECHNIC FLARE COMPOSITIONS
D. Juknelevicius
Vilnius University, Vilnius, LT

P 48 INFLUENCE FACTORS AND RESPONSE CHARACTERISTICS OF VARIOUS LLM-105 BASED PBXS UNDER COMPRESS AND SHEAR
Dai Xiaogan, Wen Yushi, Yang Zhijian
Institute of Chemical Materials CAEP, Mianyang, PRC

P 49 STUDIES ON ADIABATIC SHEAR FRACTURE OF METAL PLATE UNDER DETONATION EFFECT OF PERFUSION EXPLOSIVE
Feiyun Chen, Xiaoan Wei, Peng Wang, Weidong He, Zeshan Wang
Nanjing University of Science and Technology, Nanjing, PRC
Zhongyu Liu
Shandong Yinguang Technology Co. Ltd., Shandong, PRC

P 50 THE INVESTIGATION OF LITHIUM-BASED FLARE AND STROBE FORMULATIONS
J. Glück, T.M. Klapötke
University of Munich (LMU), München, D
J.J. Sabatini
US Army Research Laboratory Energetics Technology Branch, Aberdeen Proving Ground, USA

P 51 THERMAL DEGRADATION STUDIES OF NITRATED HTPB AND ITS EFFECTS ON THE DECOMPOSITION OF AP
Wei-Chi Li
National Chung Shan Institute of Science and Technology, Taoyuan, ROC

P 52IGNITION AND COMBUSTION OF COMPOSITE SOLID PROPELLANTS CONTAINING AL/FE AND AL/B POWDERS
A. Korotkikh, I. Sorokkin, E. Selikhova
Tomsk Polytechnic University, Tomsk, RUS
V. Arkhipov
Tomsk State University, Tomsk, RUS
P 53 EXPERIMENTAL AND THEORETICAL INVESTIGATION ON Ti(NN)_x
(x = 1 ~6) COMPLEXES
Hae-Wook Yoo, Soo Gyeong Cho
Agency for Defense Development, Daejeon, ROK
Changhyeok Choi, You sung Jung
Korea Advanced Institute of Science and Technology, Daejeon, ROK
Myong Yong Choi
Gyeongsang National University, Jinju, ROK

P 54 STUDY ON THE APPLICATION OF MAGNESIUM POWDER IN LOW-BURNING-RATE NEPE PROPELLANT
Yin Xin-Mei, Chai Yu-Ping, Tang Quan, Wang Xiao-Ying
Hubei Institute of Aerospace Chemotechnology, Xiangyang, PRC

P 55 SIGNIFICANTLY ENHANCED THERMAL DECOMPOSITION PROPERTIES OF CL-20 BASED ON THREE-DIMENSIONAL HIERARCHICALLY ORDERED POROUS CARBON
Jin Chen, Hui Huang
Institute of Chemical Materials CAEP, Mianyang, PRC /
Nanjing University of Science and Technology, Nanjing, PRC
Simin He, Bi Huang, Guangchong Yang
Institute of Chemical Materials CAEP, Mianyang, PRC

P 56 STUDY ON SILICONE RUBBER INSULATION MATERIAL OF RAMJET MOTOR
Chih-Kai Liang, Chi-Fa Hsieh, Yu-Tse Lin
National Chung-Shan Institute of Science and Technology, Longtan Dist., ROC

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