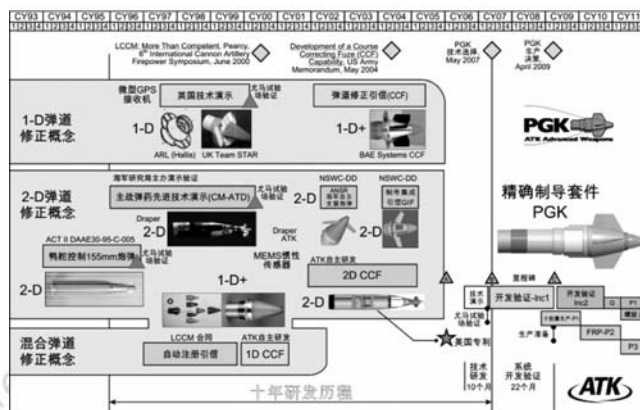


## Development of Smart Munitions



Course correcting munitions correct trajectories with their fuze dits, so they are very cheap compared with guided munitions. In recent years more attentions are paid to the development of course correction munitions, and many course correcting fuzes (CCFs) are developed such as 1D CCFs and 2D CCFs and PGK for U. S. A. Army is the new version of CCFs.

SUN Chuan-jie, QIAN Lin-xin, HU Yan-hui, GAO Hai-ying, LIU Fei

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 661 –668

## Crystallization Meta-stable Characteristics of RDX in Water-containing Cyclohexanone

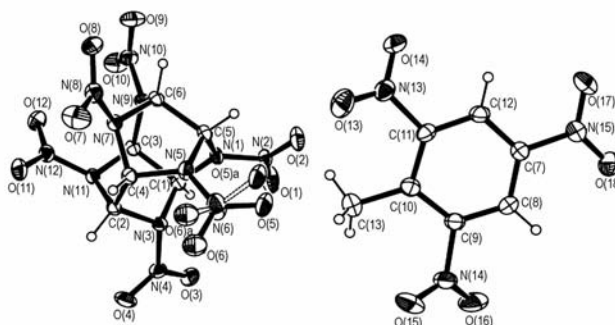


The large spherical particle transparent RDX crystal was obtained by adding the RDX crystal seed in water-cyclohexanone-RDX solution, which was in metastable state.

HUANG Ming, MA Jun, YAN Guan-yun, CHEN Bo

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 669 –673

## Preparation, Structure and Properties of CL-20/TNT Cocrystal

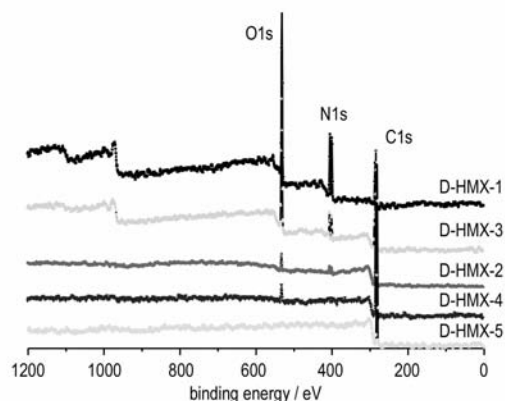


The CL-20/TNT cocrystal explosive in a 1 : 1 molar ration was prepared by using solution cocrystallization. The crystal structure was determined by single crystal X-ray diffraction (SXRD).

YANG Zong-wei, ZHANG Yan-li, LI Hong-zhen, ZHOU Xiao-qing, NIE Fu-de, LI Jin-shan, HUANG hui

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 674 –679

## Desensitizing Technology of High Quality HMX by Coating

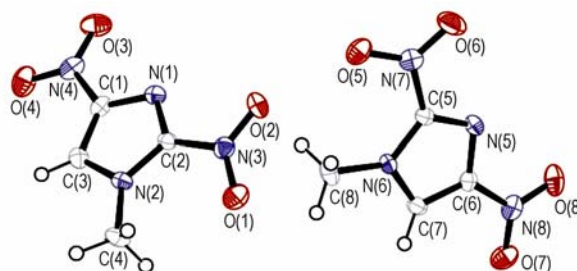


The high-quality HMX (D-HMX) can be coated entirely by W and TPU by means of surface energies testing-calculating of materials and SEM, XPS were used to characterize the coated D-HMX samples. The impact and friction sensitivity of high-quality HMX samples coated by W decreases significantly, especially coating in non-aqueous media. The insensitive composite particles were obtained by coating the insensitive additive (W or W and TPU) onto the surface of high-quality HMX.

LI Yu-bin, HUANG Heng-jian, HUANG Hui, LI Shang-bin, GUAN Li-feng

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 680 –684

## Crystal Structure and Thermodynamic Properties of 1-Methyl-2,4-dinitroimidazole

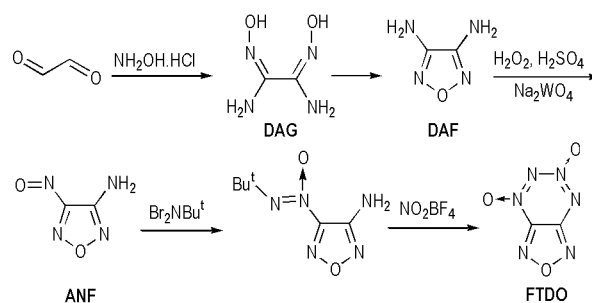


The single crystal of 1-methyl-2,4-dinitroimidazole (2,4-MDNI) was cultivated by acetone. Its crystal structure and thermodynamics properties were characterized by X-ray diffraction and TG-DSC, respectively.

ZHANG Xiao-yu, CHI Yu, HUANG Ming, WANG Jun

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 685 –689

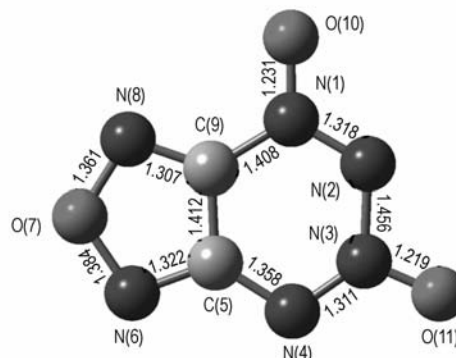
## Synthesis of Furazano[3,4-e]-1,2,3,4-tetrazine-1,3-dioxide



DONG Lin-lin, ZHANG Guang-quan, CHI Yu, FAN Gui-juan, HE Ling, TAO Guo-hong, HUANG Ming

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 690 –692

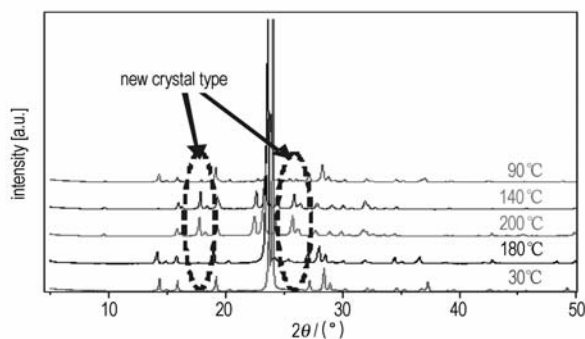
### Structure and Properties of Furazano[3,4-e]-1,2,3,4-tetrazine-1,3-dioxide



HE Ling, DONG Lin-lin, ZHANG Guang-quan, TAN Bi-sheng, HUANG Ming, TAO Guo-hong  
*Chinese Journal of Energetic Materials*, 2012, 20(6): 693–696

Optimized geometry, atomic numbers and bond lengths (Å) of Furazano[3,4-e]-1,2,3,4-tetrazine-1,3-dioxide (FTDO) were calculated using density functional theory with B3LYP/6-31+G(d,p) level.

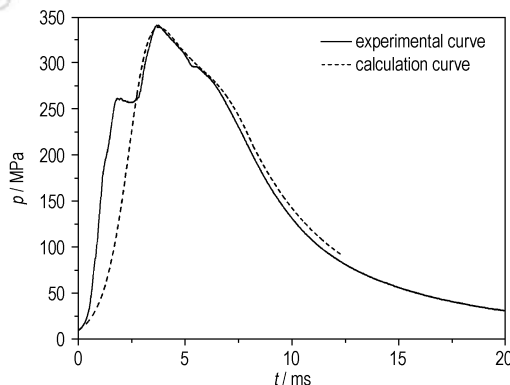
### Phase Transition and Thermal Decomposition Behaviors of 4,4'-Bis-1,2,4-triazole



CHI Yu, ZHANG Xiao-yu, LIU Yu, ZHANG Yong, HUANG Ming, LI Hong-bo  
*Chinese Journal of Energetic Materials*, 2012, 20(6): 697–700

The phase transition and thermal behavior of 4,4'-bis-1,2,4-triazole (BTz) were studied with in-situ X-ray diffraction, differential scanning calorimetry and thermogravimetry.

### Potential Equilibrium Theory Simulation of Interior Ballistic of Low Temperature Sensitivity Coated Propellant Charge

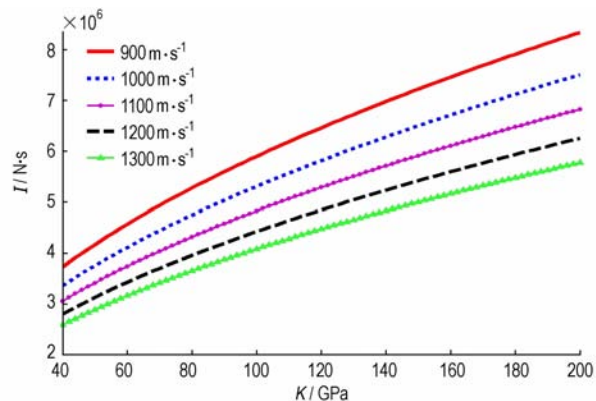


LIU Zhi-tao, XU Bin, NAN Feng-qiang, LIAO Xin, WANG Ze-shan  
*Chinese Journal of Energetic Materials*, 2012, 20(6): 701–704

The simulation of the interior ballistic with standard charge and the low temperature sensitivity coated propellant charge was carried out based on the potential equilibrium theory.

### Interaction Performance of PELE Penetrating Target Plate with Different Material

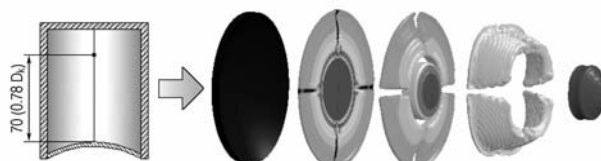
SONG Cheng-Jun, SONG Li-li, DU Zhong-hua, YE Xiao-jun, TUO Jin-kui  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 705 – 709



Impulse of inner subjected is increases with the target volume modulus increasing When PELE impact plate at different velocity. And jacket produced larger radial velocity for the jacket radial force increasing , that means that fragment of jacket can obtain larger radial velocity.

### Influence of Initiation Point Position on Formation of MEFP

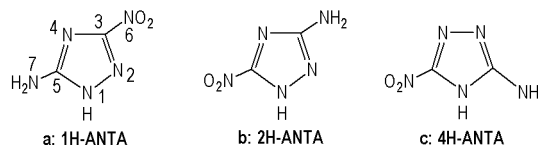
ZANG Li-wei, YIN Jian-ping, WANG Zhi-jun  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 710 – 714



Under fixed cutting reseau distance, initiation point distance has a best formation at 0.78  $D_k$  in order to form five ideal sub-explosively formed projectile which have a definite mass, direction, and velocity.

### Review on Synthesis and Reactivity of 5-Amino-3-nitro-1, 2, 4-triazole

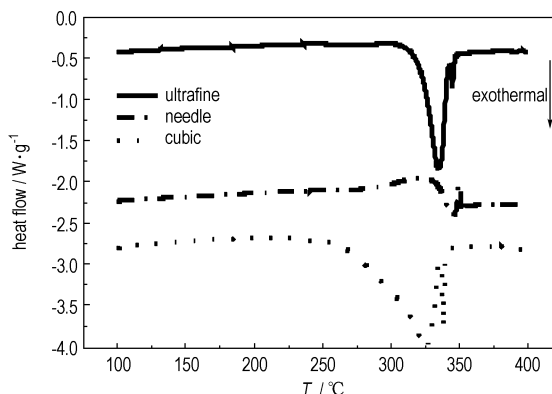
HE Yun, FAN Gui-juan, ZHANG Guang-quan, HUANG Ming, LIU Yu-cun  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 715 – 720



The structure of ANTA has -NH and -NH<sub>2</sub> two reaction centers to take part in many reactions with various compounds. The ANTA can be used as an intermediate for synthesising new insensitive high explosives.

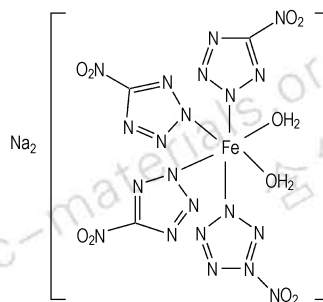
### Characterization of a Heat-resistant Explosive ANPZO

LIU Yu-cun, LIU Deng-cheng, YANG zong-wei, ZHANG Yi, TAN Yan-wei, WANG Jian-hua  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 721 – 725



Thermal safety of 2,6-diamino-3,5-dinitropyrazine-1-oxide (ANPZO) was studied. ANPZO is thermally stable with maximum heat release peak value over 350 °C.

### Synthesis and Performances of Green Primary Explosive Sodium Tetra (5-nitrotetrazolate) Diaquate Ferrate (II)

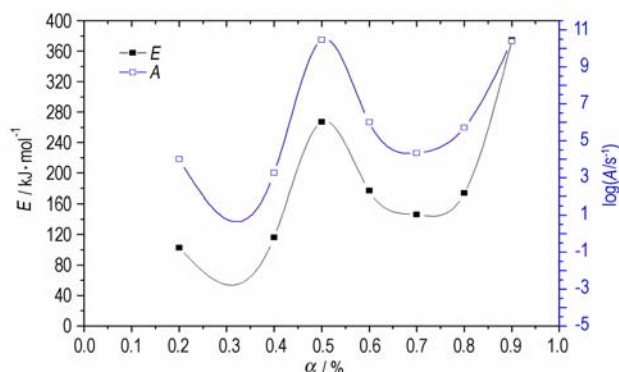


Sodium tetra (5-nitrotetrazolate) diaquate ferrate (II) (NaFeNT) was synthesized from sodium 5-nitrotetrazolate ferrous chloride, and its structure was characterized by elemental analysis, scanning electron microscopy, energy dispersive spectrometry, and Fourier transform infrared.

ZHU Ya-hong, SHENG Di-lun, WANG Yan-lan, CHEN Li-kui,  
YANG Bin, PU Yan-li

*Chinese Journal of Energetic Materials*, 2012, 20(6): 726–730

### Thermal Behaviour and Decomposition Reaction Kinetics of Graphite/potassium Nitrate

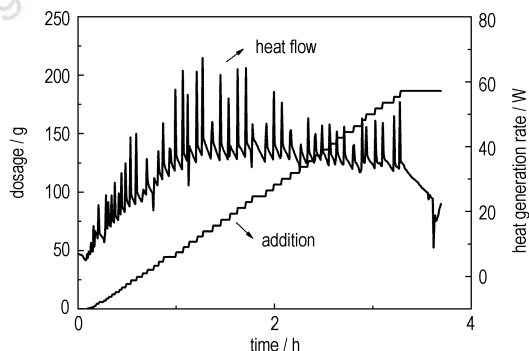


WANG Hui-e, SHEN Rui-qi, YE Ying-hua, WU Li-zhi

*Chinese Journal of Energetic Materials*, 2012, 20(6): 731–734

C/KNO<sub>3</sub> decomposition process is complex with three or more reaction.

### Thermal Effects of Synthesis Process of ADN

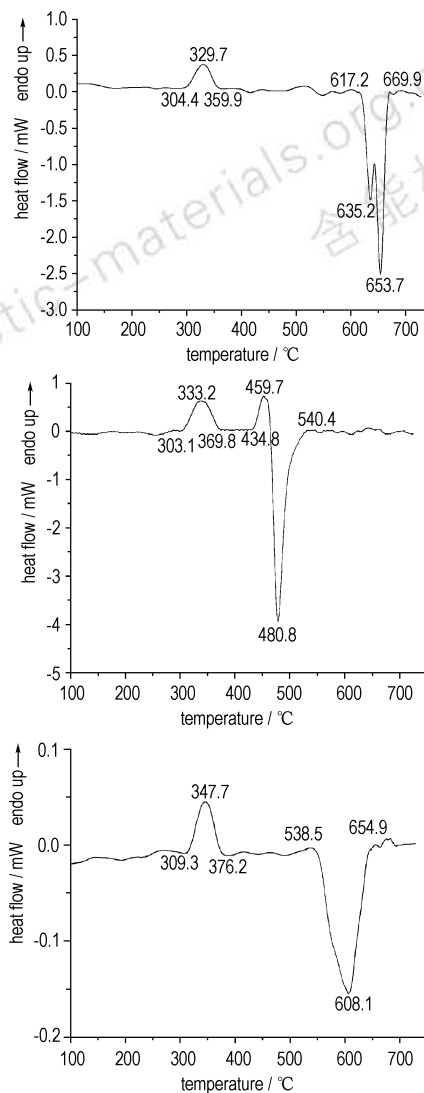


The heat release law of the synthesis process of ADN was determined by using reaction calorimeter RC1e. The technical process comprises four stages: neutralization, mixing of nitric acid and sulfuric acid, nitration under lower temperature, amination.

ZHU Yong, WANG Yu, LIU Jian-li, LI Pu-rui, ZHANG Zhi-gang

*Chinese Journal of Energetic Materials*, 2012, 20(6): 735–738

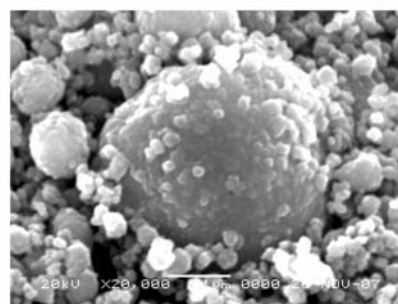
### Safety and Combustion Properties of $\text{RbNO}_3$ Infrared Pyrotechnic Composition



DSC curves above show that the order of combustion temperature of the mixed pyrotechnic composition is  $\text{TiH}_2/\text{RbNO}_3/\text{FPM} < \text{Al}_3\text{Mg}_4/\text{RbNO}_3/\text{FPM} < \text{Mg}/\text{RbNO}_3/\text{FPM}$ , and the thermal decomposition process of  $\text{B}/\text{RbNO}_3/\text{FPM}$  is similar to that of  $\text{Ti}/\text{RbNO}_3/\text{FPM}$ , and no combustion reaction takes place within  $700^\circ\text{C}$ .

MIAO Yan-ling, QIAO Xiao-jing, ZHANG Qiang, ZHOU Zun-ning  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 739–743

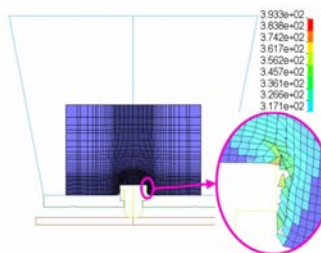
### Effect of Nano-ferric-oxide on HTPB Propellant Performance



LIU Chang-bao, LIU Xue, HU Qi-wei, Li Yan-rong  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 744–747

The effects of nano-ferric-oxide on the mechanical performances, combustion characteristics and safety properties of HTPB propellant were studied.

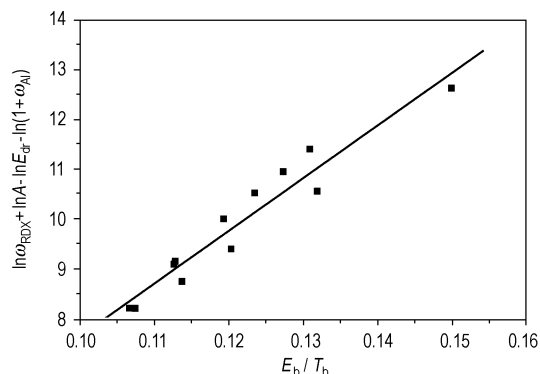
### Numerical Simulation for Spigot Tests



The numerical model of spigot test was developed. The elements-apart method was used to describe fragmentation of explosive. The critical drop velocity, inside temperature and fragmentation of explosive were calculated.

WANG Chen, CHEN Lang, LU Feng, HUANG Yi-ming, HE Le  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 748 – 753

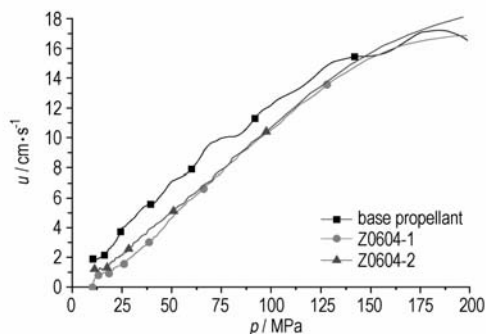
### Relationship between Drop Energy and Heat Explosion Parameters of RDX-based Aluminized Explosives



The drop height ( $H_{50}$ ) of RDX-based aluminized explosives first fall down and then rise with the increasing of RDX contents. Additionally, a linear relationship exists between the drop energies and heat explosion parameters, such as explosion temperature, heat explosion activation energy, logarithm of pre-exponential factor.

ZHENG Ya-feng, ZHANG Hai, ZHANG Xiu-bo, IU Zi-ru,  
LU Hong-lin, REN Xiao-ning, WANG Xiao-hong  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 754 – 757

### Burning Rate Model of Modified Single Base Propellant



The dipping layer distribution in grain, the changes of grain size and energetic characteristic in combustion process for the modified single base propellant were studied by closed bomb test, micrograph observation of grain slices and established burning rate model.

ZHANG Jiang-bo, ZHANG Yu-cheng, LI Qiang,  
YAN Wen-rong, YAN Guang-hu, LIU Qiang, DU Jiang-yuan  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 758 – 761



### Grey Relational Analysis in Influencing Factors of NEPE Propellant Sensitivity

QIN Chao, ZHAO Xiao-bin, LI Jun

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 762 –765

Values and sequences of Grey relation

gray correlation	grey relation degree					significant level
	S	$m_{AP}$	$m_{Al}$	$m_{HMX}$	$m_{PL}/m_{PO}$	
impact sensitivity	0.669	0.638	0.556	0.653	0.641	$S > m_{HMX} > m_{PL}/m_{PO} > m_{AP} > m_{Al}$
friction sensitivity	0.740	0.630	0.741	0.609	0.769	$m_{PO} > m_{AP} > m_{Al} > S > m_{AP} > m_{HMX}$
electrostatic spark sensitivity	0.660	0.631	0.638	0.556	0.587	$S > m_{Al} > m_{AP} > m_{PO} > m_{AP} > m_{HMX}$
shock sensitivity	0.722	0.455	0.647	0.740	0.660	$m_{HMX} > S > m_{PO} > m_{AP} > m_{Al} > m_{AP}$
5 s explosion temperature	0.599	0.597	0.523	0.668	0.642	$m_{HMX} > m_{PO} > m_{AP} > S > m_{AP} > m_{Al}$
flame sensitivity	0.663	0.543	0.633	0.622	0.604	$S > m_{Al} > m_{HMX} > m_{PO} > m_{AP} > m_{AP}$
regional thermal sensitivity	0.699	0.603	0.583	0.638	0.749	$m_{PO} > m_{AP} > S > m_{HMX} > m_{AP} > m_{Al}$

The numerical method was used to calculate the grey relationship degree from composition and granularities.

### Detonation Transmission Reliabilities Estimation of Air-gap Interface by D-optimized Method

ZHANG Li-min, MU Hui-na, DONG Hai-ping, LI Zhi-liang

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 766 –769



The testing device and reliability data analysis method of evaluating air-gap detonation transmission interface function were studied and presented by D-optimized method.

### Explosion Energy Prediction of Aluminized Explosive

CHANG Yan, ZHANG Qi

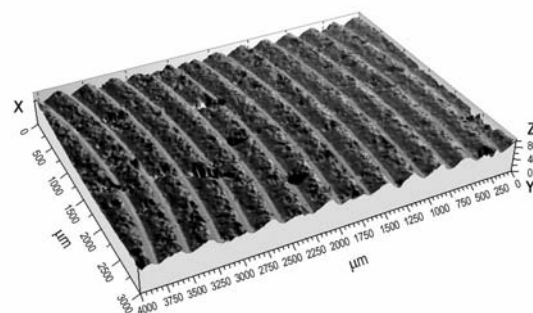
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 770 –774

Build a non-ideal detonation energy predicting mode after theoretical analysis and compile the software by numerical iteration and numerical preparation.

### Evaluation of Cutting Surface Roughness of PBX Explosive and Its Influence Factors

ZHANG Qiu, LIU Wei, TANG Xian-jin

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 775 –778



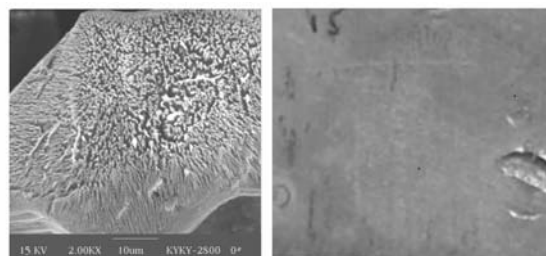
The 3D surface micro-structure of the pressed PBX lathed surfaces was detected. The 3D and 2D surface roughness parameters were evaluated. The main factors affecting the surface roughness were analyzed.

### Microstructures of ANFO and Their Effects on Detonator Initiation Sensitivity

ZENG Gui-yu, YU Wei-fei, LI Wei, GAO Da-yuan,

HUANG Hui, Lü Chun-xu

*Chinese Journal of Energetic Materials*, 2012, 20(6) : 779 –783



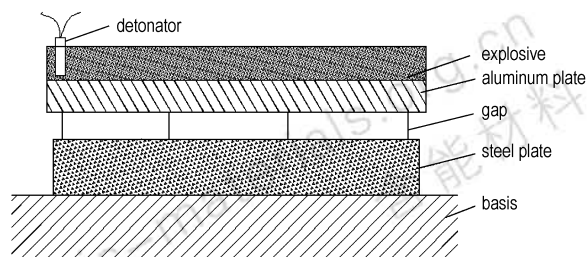
Expanded ammonium nitrate-oil explosives (ANFO) particles have many holes and cracks. This porous microstructure is helpful to enhance the detonator initiation sensitivity of explosive.



### Experimental Study on Expanded ANFO Explosive of Low Detonation Velocity Used in Explosive Welding

HUANG Wen-yao, YU Yan, WU Hong-bo, LI Ya, YOU You, YUAN Sheng-fang

*Chinese Journal of Energetic Materials*, 2012, 20(6): 784–788

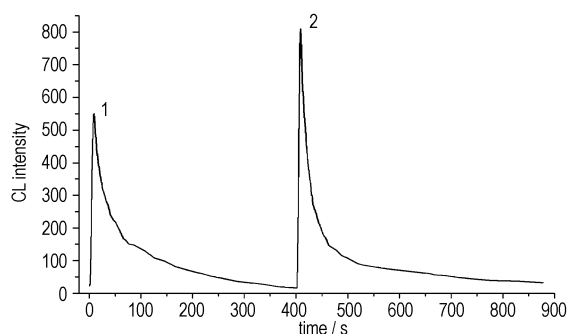


Expanded ANFO Explosive of low detonation velocity was used to weld aluminum-steel plate. The layout thickness of explosive was 32 mm, and the initiating method was used by electrical detonator, and the recombination rate of explosion was up to 99%.

### Determination of Trace Unsymmetrical Dimethyl Hydrazine in Water by Luminol-Potassium Periodate Post-chemiluminescence Method

WU Wan-e, MENG Xiao-hong, ZHANG Hui-tan

*Chinese Journal of Energetic Materials*, 2012, 20(6): 789–793

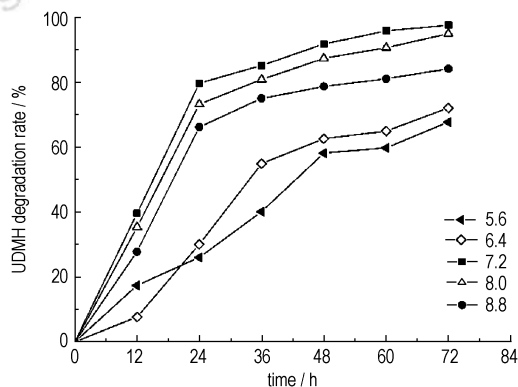


A new method for the determination of trace UDMH was established based on the studies of the post chemiluminescence (PCL). The dynamics curve of PCL phenomenon was obtained when unsymmetrical dimethyl hydrazine (UDMH) solution was injected into a solution after the finish of CL reaction of alkaline luminol and potassium periodate.

### A Biodegradation Method Towards UDMH Leaking into Water

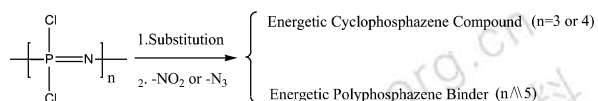
XIA Ben-li, FAN Chun-hua, WANG Xuan-jun, WANG Li

*Chinese Journal of Energetic Materials*, 2012, 20(6): 794–798



The compound flora FYD was build. The effects of temperature, pH, inoculums and the initial UDMH concentration on UDMH degradation of flora FYD rate were discussed.

### Development of Synthesis and Application on Phosphazene Energetic Compounds



The development and application of energetic cyclophosphazene compound and energetic polyphosphazene binder in recent years were classifiedly reviewed. Meanwhile, the development direction of energetic phosphazene material was prospected.

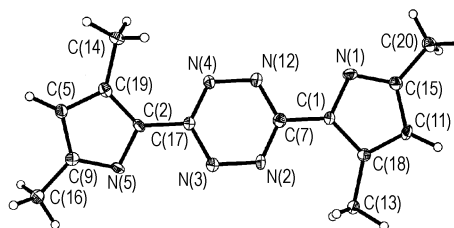
XIAO Xiao, GAN Xiao-xian, YU Hong-jian, LIU Qing, LI Lei  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 799 –804

### Review on Insensitive Non-metallic Energetic Ionic Compounds of Tetrazolate Anions

The progresses in the insensitive non-metallic energetic ionic compounds of aminotetrazolate, nitrotetrazolate, nitraminotetrazolate, azotetrazolate and furazan functionalized tetrazolate anions were reviewed in detail and new trends in research of insensitive non-metallic energetic ionic compounds of tetrazolate anion were proposed.

BI Fu-qiang, FAN Xue-zhong, XU Cheng, WANG Bo-zhou, ZHENG Ya-feng, GE Zhong-xue, LIU Qing  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 805 –811

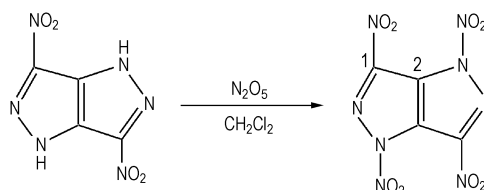
### Crystal Structure of 3,6-Bis(3,5-dimethylpyrazol-1-yl)-1,2,4,5-tetrazine



3,6-Bis(3,5-dimethylpyrazol-1-yl)-1,2,4,5-tetrazine (BT) was synthesized by oxidation of 3,6-bis(3,5-dimethylpyrazol-1-yl)-1,2-dihydro-1,2,4,5-tetrazine (BDT) with  $\text{NO}_2$ . Its single crystal was determined by X-ray diffraction at a low temperature of 93(2) K.

SUN Mou, ZHANG Jian-guo, FENG Jin-ling, WU Jin-ting, ZHANG Tong-lai, SHU Yuan-jie  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 812 –813

### Synthesis of 1,3,4,6-Tetranitropyrazolo[4,3-c]pyrazole (TNPP)



Using 1H,4H-3,6-dinitropyrazolo[4,3-c]pyrazole (DNPP) as a starting material, a novel energetic material 1,3,4,6-tetranitropyrazolo[4,3-c]pyrazole (TNPP) was synthesized by  $\text{N}_2\text{O}_5$  nitration in  $\text{CH}_2\text{Cl}_2$ .

LUO Yi-fen, WANG Bo-zhou, CHEN Xiao-fang, LI Ya-nan, LI Wen-jie  
*Chinese Journal of Energetic Materials*, 2012, 20(6) : 814 –815

Executive editor: WANG Yan-xiu JIANG Mei; Computer typesetter: ZHANG Gui-hong