

EI 收录期刊
中文核心期刊
中国科技核心期刊

ISSN 1007—7812
CODEN HUXUFP

火炸药学报

HUOZHAYAO XUEBAO

CHINESE JOURNAL OF
EXPLOSIVES & PROPELLANTS

Vol.42 No.5

2019

中国兵工学会

ISSN 1007-7812



本刊系全国中文核心期刊(《中文核心期刊要目总览》2017年版)、国务院《学位与研究生教育重要期刊》、科技部《中国科技论文统计源期刊》(中国科技核心期刊)、中国科学院《中国科学引文数据库》及中国科协《中国学术期刊文摘(英文版)》、美国《化学文摘》(CA)、Elsevier出版集团的Scopus数据库、Ei Compendex数据库、俄罗斯《文摘杂志》(AJ)、日本JST China数据库、美国《乌利希期刊指南(网络版)》(Ulrichsweb)、美国艾博思科(EBCO)数据库收录源刊。

刊名题写:张爱萍

目次

原子层沉积技术在含能材料表面修饰中的应用研究进展 秦利军,龚婷,闫宁,李建国,惠龙飞,郝海霞,冯昊(425)

6-(3,5-二甲基-1H-吡唑)-1,2,4,5-四嗪-3-酮(DPTzO)及其胍盐的晶体结构和热分解行为 张聪,陈湘,白杨,郭兆琦,马海霞(432)

3-甲氧基-6-硝胺基-1,2,4,5-四嗪化脲的制备、结构与性能研究 任杰,张天河,李志敏,王林,张同来(438)

高能不敏感离子盐 HDNMT 和 ADNMT 的合成、热行为与能量特性 霍欢,郭涛,王子俊,毕福强,王伯周(445)

Periodic DFT Study on High Pressure Behavior of Nitrogen-rich Energetic Crystal 4-Amino-3,7-Dinitrotriazolo-[5,1,c][1,2,4] Triazine YANG Dong-fang, LI Hui-li, LIU Jin-jian, ZHAO Guo-zheng, LU Ming(450)

3-硝基胍-1,2,4,3-唑[4,3-b]-s-四嗪及其胍基胍盐的合成与性能研究 贾思媛,张海昊,毕福强,王伯周,张家荣(455)

端丙炔基聚丁二烯预聚物的贮存稳定性 高文博,李永辉,何吉宇,杨荣杰(460)

活性炭吸附 ADN 过程的动力学与热力学 潘永飞,汪营磊,刘卫孝,赵宝东,陈斌(465)

FOX-7 在 DMSO-H₂O、DMSO-EtOH、DMSO-ACE 二元混合体系中的溶解度及结晶 赵鑫华,曹端林,王建龙,陈丽珍,章越扬,周诚(473)

耐低温乳胶基质的制备与性能测试 齐秀芳,王杰,何俊蓉,陈李和,唐杰(480)

DNTF 凝固过程显微疏松的模拟计算和试验研究 刘瑞鹏,贾宪振,王永顺(485)

基于爆炸成型弹丸(EFP)的大锥角喇叭罩成型规律 王雅君,李伟兵,李文彬,王晓鸣,王桂林(490)

挤出滚圆造粒法制备团聚硼颗粒 张怀龙,吴瑞强,肖乐勤,周伟良,龙义强(497)

自由装填推进剂用含醛基/烯丙基芳氧基聚磷腈包覆材料研究(I):制备、硫化特性及力学性能 曹继平,肖啸,魏乐,赵凤起,杨士山(504)

原位拉伸扫描电镜法研究 GAP 推进剂的损伤行为 杨秋秋,蔡如琳,徐胜良,张箭,黄志萍,周明川(511)

一缩二乙二醇二硝酸酯中有机杂质的定性和定量分析 陈爽,康莹,胡银,索志荣,孟俞富,宁艳利(516)

纤维素甘油醚硝酸酯基模压可燃药筒的制备与性能 李忠山,田书春,周逸,邵自强,周晓红,袁小丽,郭炳毅(521)

TNT 坑道内爆炸热作用规律的试验研究 张玉磊,李芝绒,张俊锋,潘文,王胜强(526)

* * * * *

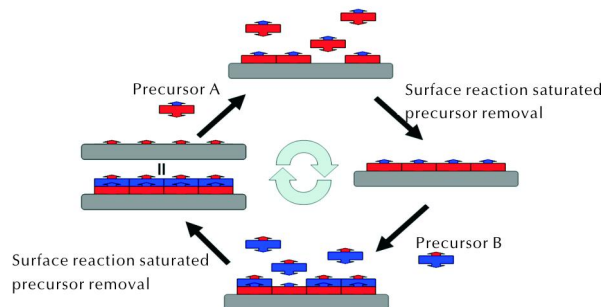
本刊实现单篇文章网络首发 (431)

行业动态:基于数字驱动连续大颗粒冷冻结晶技术取得成功 (449)

Contents

Research Progress on Application of Atomic Layer Deposition in Surface Fabrication of Energetic Materials	QIN Li-jun ,GONG Ting ,YAN Ning ,et al (425)
Crystal Structure and Thermal Decomposition Behaviors of 6-(3,5-Dimethyl-1H-pyrazole)-1,2,4,5-tetrazin-3-one (DPTzO) and Its Guanidine Salt	ZHANG Cong , CHEN Xiang , BAI Yang , et al (432)
Synthesis , Structure and Properties of 3-Methoxyl-6-nitramine -1,2,4,5-tetrazylated Urea	REN Jie , ZHANG Tian-he , LI Zhi-min .et al (438)
Synthesis , Thermal Behavior and Energy Characteristics of Insensitive High Energetic Ionic Salts of HDNMT and ADNMT	HUO Huan , GUO Tao , WANG Zi-jun ,et al (445)
Periodic DFT Study on High Pressure Behavior of Nitrogen-rich Energetic Crystal 4-Amino-3,7-Dinitrotriazolo-[5,1,c][1,2,4]Triazine	YANG Dong-fang , LI Hui-li , LIU Jin-jian ,et al (450)
Synthesis and Performances of 3-Nitroguanidino-1,2,4-triazolo[4,3-b]-s-tetrazine and Its Guanlylurea Salts	JIA Si-yuan , ZHANG Hai-hao , BI Fu-qiang .et al (455)
Study on the Storage Stability of Propargyl-Terminated Polybutadiene Prepolymer	GAO Wen-bo , LI Yong-hui , HE Ji-yu ,et al (460)
Adsorption Kinetics and Thermodynamics of ADN on Activated Carbon	PAN Yong-fei ,WANG Ying-lei , LIU Wei-xiao ,et al (465)
Solubility and Crystallization of FOX -7 in DMSO-H ₂ O , DMSO-EtOH and DMSO-ACE Binary Mixed Solvents	ZHAO Xin-hua , CAO Duan-lin , WANG Jian-long ,et al (473)
Preparation and Characterization of Emulsion Matrix with Low Temperature Resistance	QI Xiu-fang , WANG Jie , HE Jun-rong ,et al (480)
Numerical Simulation and Experimental Study of Microporosity of DNTP during Solidification Process	LIU Rui-peng , JIA Xian-zhen , WANG Yong-shun (485)
Formation Characteristics of Trumpet-shaped Liner with Large Cone Angle Based on Explosively Formed Penetrator (EFP)	WANG Ya-jun ,LI Wei-bing ,LI Wen-bin , et al (490)
Preparation of Agglomerated Boron Particles by Extrusion-spheronization Method	ZHANG Huai-long , WU Rui-qiang , XIAO Le-qin ,et al (497)
Study of Aldehyde/allyl-aryloxypolyphosphazene-based Inhibition Materials for Insertion Solid Propellant (I) : Synthesis , Vulcanization Characteristics and Mechanical Properties	CAO Ji-ping , XIAO Xiao , WEI Le ,et al (504)
Damage Behavior of GAP Solid Propellant by In-situ Tensile SEM Method	YANG Qiu-qiu , CAI Ru-lin , XU Sheng-liang .et al (511)
Qualitative and Quantitative Analysis of Organic Impurities in Diethylene Glycol Dinitrate	CHEN Shuang , KANG Ying , HU Yin ,et al (516)
Preparation and Performances of Molded Combustible Cartridge Cases Modified by NCEC	LI Zhong-shan , TIAN Shu-chun , ZHOU Yi ,et al (521)
Experimental Study on the Thermal Effect of TNT Explosion in Tunnel	ZHANG Yu-lei ,LI Zhi-rong ,ZHANG Jun-feng ,et al (526)

Research Progress on Application of Atomic Layer Deposition in Surface Fabrication of Energetic Materials

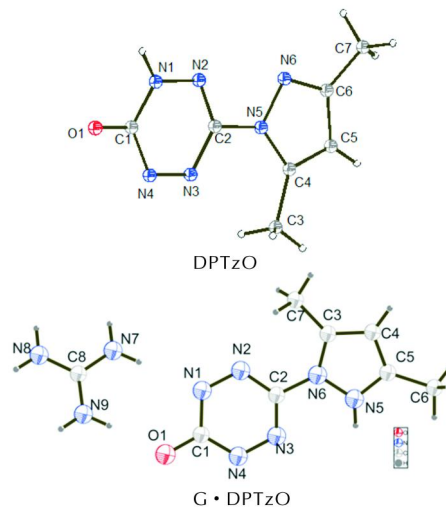


ALD is a thin film coating technology featuring unique capabilities such as precise film thickness control, low temperature deposition, large area and three-dimensional uniformity. These features make ALD a promising technology for fabricating energetic materials. In this article, the latest research progresses on ALD fabrication of energetic materials were reviewed.

QIN Li-jun, GONG Ting, YAN Ning, LI Jian-guo, HUI Long-fei, HAO Hai-xia, FENG Hao

Chinese Journal of Explosives & Propellants, 2019, 42(5):425-431.

Crystal Structure and Thermal Decomposition Behaviors of 6-(3,5-Dimethyl-1H-pyrazole)-1,2,4,5-tetrazin-3-one (DPTzO) and Its Guanidine Salt

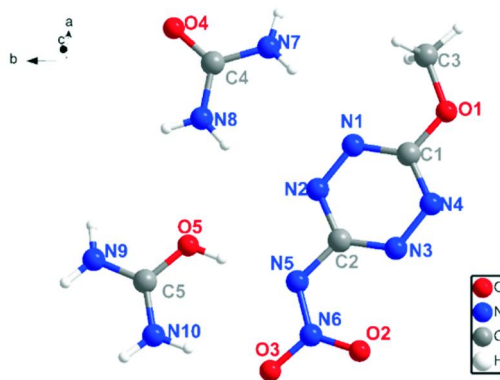


DPTzO and its guanidine salt ($G \cdot DPTzO$) were synthesized and the structures were characterized by FT-IR, EA, 1H NMR, ^{13}C NMR and XRD. The thermal decomposition processes of the two compounds were analyzed by DSC and TG-DTG under non-isothermal conditions.

ZHANG Cong, CHEN Xiang, BAI Yang, GUO Zhao-qj, MA Hai-xia

Chinese Journal of Explosives & Propellants, 2019, 42(5):432-437.

Synthesis, Structure and Properties of 3-Methoxyl-6-Nitramine-1,2,4,5-tetrazylated Urea

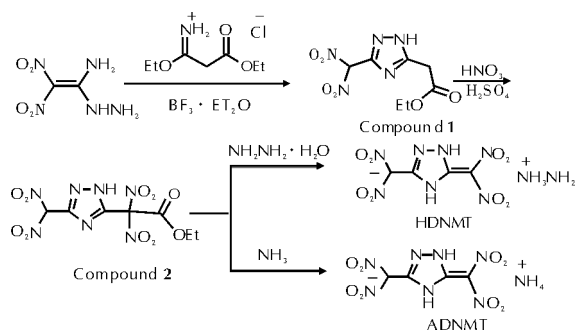


An energetic compound of 3-methoxyl-6-nitramine-1,2,4,5-tetrazylated urea was synthesized by reaction of urea with 3,6-dinitramine-1,2,4,5-tetrazine in methanol. Its thermal behaviors, heat of combustion and sensitivities were studied.

REN Jie, ZHANG Tian-he, LI Zhi-min, WANG Lin, ZHANG Tong-lai

Chinese Journal of Explosives & Propellants, 2019, 42(5):438-444.

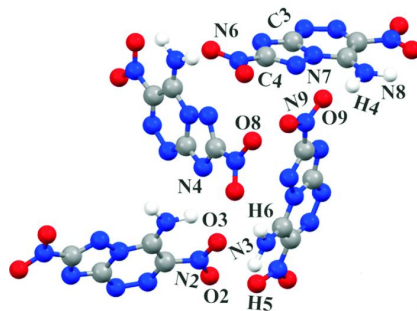
Synthesis, Thermal Behavior and Energy Characteristics of In-sensitive High Energetic Ionic Salts of HDNMT and ADNMT



Two kinds of insensitive energetic ionic salts, mono-hydrazinium 3,5-bis(dinitromethyl)-1,2,4-triazolate (HDNMT) and mono-ammonium 3,5-bis(dinitromethyl)-1,2,4-triazolate (ADNMT), were synthesized via the reactions of cyclization, nitration and alkali-hydrolysis. Their structures were characterized by FT-IR, ^1H NMR, ^{13}C NMR and elemental analysis. The thermal behaviors of HDNMT and ADNMT were studied by DSC and TG-DTG. The energy characteristics of modified double-base (CMDB) propellant containing HDNMT and ADNMT were calculated by NASA-CEA software under the standard condition.

HUO Huan, GUO Tao, WANG Zi-jun, BI Fu-qiang, WANG Bo-zhou
Chinese Journal of Explosives & Propellants, 2019, 42(5):445-449.

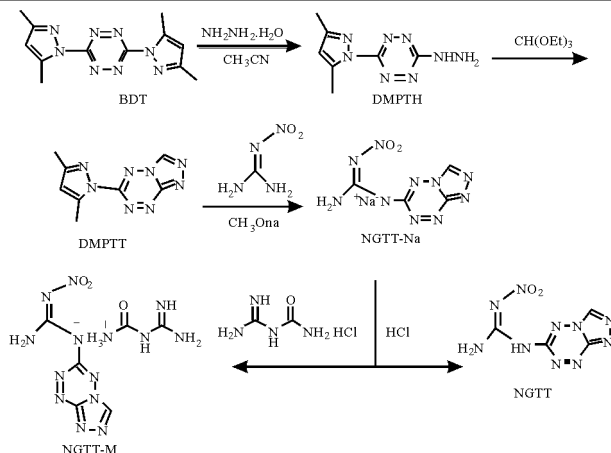
Periodic DFT Study on High Pressure Behavior of Nitrogen-rich Energetic Crystal 4-Amino-3,7-Dinitrotriazolo-[5,1,c][1,2,4] Triazine



The high pressure behavior of nitrogen-rich energetic crystal 4-amino-3,7-dinitrotriazolo-[5,1,c][1,2,4]triazine (DPX-26) in the hydrostatic pressure range of 0—130 GPa was investigated by employing the GGA/PBE-G06 method of periodic density functional theory (DFT). The changes of crystal structure, molecular structure and electronic structure of DPX-26 with pressure were analyzed by calculating lattice parameters (a , b , c), bond lengths, band gaps (ΔE_g) and density of states (DOS).

YANG Dong-fang, LI Hui-li, LIU Jin-jian, ZHAO Guo-zheng, LU Ming
Chinese Journal of Explosives & Propellants, 2019, 42(5):450-454.

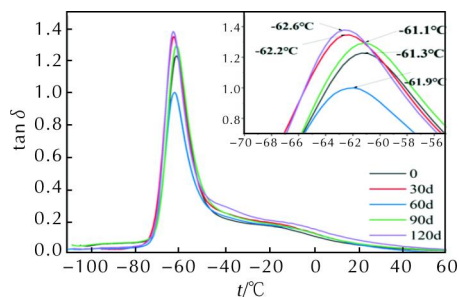
Synthesis and Performances of 3-Nitroguanidino-1,2,4-triazolo[4,3-b]-s-tetrazine and Its Guanylurea Salts



3-Nitroguanidino-1,2,4-triazolo[4,3-b]-s-tetrazine (NGTT) was synthesized and its N-guanylurea salt was obtained. Their structures, thermal stabilities, detonation velocities, detonation pressures and specific impulses as monopropellant were characterized and calculated.

JIA Si-yuan, ZHANG Hai-hao, BI Fu-qiang, WANG Bo-zhou, ZHANG Jia-rong
Chinese Journal of Explosives & Propellants, 2019, 42(5):455-459.

Study on the Storage Stability of Propargyl-Terminated Polybutadiene Prepolymer

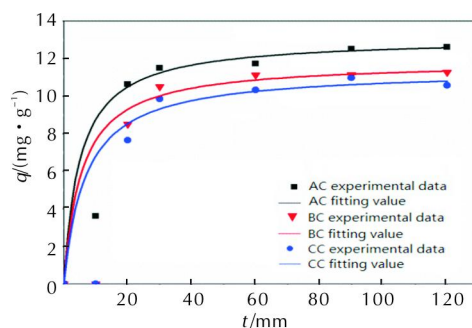


The storage stability of PTPB was investigated by tracking test. The chemical structures and properties of PTPB stored at different temperatures and times were characterized by ^{13}C -NMR, FT-IR, TG, GPC and viscosity tests. The PTPB elastomers were prepared from the stored PTPB prepolymer and azido-glycidyl ether (GAP) and the properties of elastomers were characterized by FT-IR, DMA and mechanical tests.

GAO Wen-bo, LI Yong-hui, HE Ji-yu, YANG Rong-jie

Chinese Journal of Explosives & Propellants, 2019, 42(5), 460-464.

Adsorption Kinetics and Thermodynamics of ADN on Activated Carbon

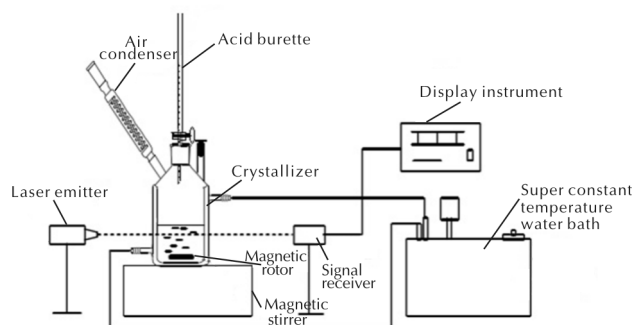


The mass fraction of ADN and AN in the mother liquor of ADN were determined by reverse high performance liquid chromatography (HPLC). The adsorption kinetic of ADN on three kinds of activated carbons were investigated by quasi-first-order adsorption kinetic model, quasi-second-order adsorption kinetic model and intra-particle diffusion model, respectively, and the adsorption thermodynamics of ADN on activated carbon AC was conducted by Langmuir and Freundlich adsorption isotherm models.

PAN Yong-fei, WANG Ying-lei, LIU Wei-xiao, ZHAO Bao-dong

Chinese Journal of Explosives & Propellants, 2019, 42(5), 465-472.

Solubility and Crystallization of FOX-7 in DMSO-H₂O, DMSO-EtOH and DMSO-ACE Binary Mixed Solvents



The solubility of FOX-7 in four pure solvents (DMSO, H₂O, EtOH, ACE) and three binary mixed solvents (DMSO-H₂O, DMSO-EtOH, DMSO-ACE) were determined by using a laser dynamic monitoring technique. The Apelblat model, Yaws model van't Hoff model were adopted to correlate the experimental solubility data. The morphology of the product crystallized in the DMSO-ACE (volume ratio of 2:1) system is uniform and spherical.

ZHAO Xin-hua, CAO Duan-lin, WANG Jian-long, CHEN Li-zhen, ZHANG Yue-yang, ZHOU Cheng

Chinese Journal of Explosives & Propellants, 2019, 42(5), 473-479.

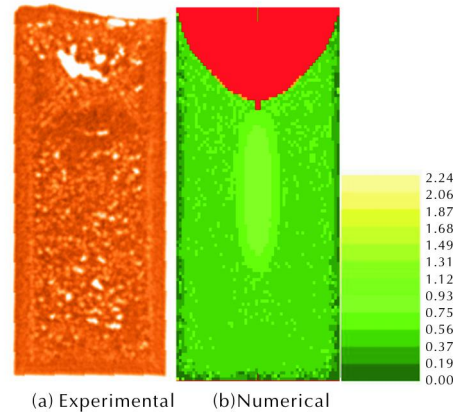
Preparation and Characterization of Emulsion Matrix with Low Temperature Resistance

Qi Xiu-fang, WANG Jie, HE Jun-rong, CHEN Li-he, TANG Jie
Chinese Journal of Explosives & Propellants, 2019, 42(5):480-484.

The storage stability of emulsion matrix of emulsion explosive at low temperature was explored based on formulation optimization. The effects of water content, emulsifier content and kinds of antifreeze agents on the low temperature resistance of emulsion matrix were investigated. The detonation velocity, sacrificial distance and intensity of the emulsion explosive were tested according to National Standard Explosive Test Methods, respectively.

Numerical Simulation and Experimental Study of Microporosity of DNTF during Solidification Process

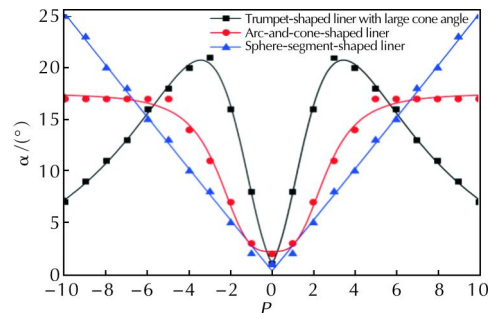
LIU Rui-peng, JIA Xian-zhen, WANG Yong-shun
Chinese Journal of Explosives & Propellants, 2019, 42(5):485-489.



The microporosity of DNTF solidification process was simulated by the advanced porosity module embedded in the ProCAST software and the numerical results were compared with the industrial CT test photos.

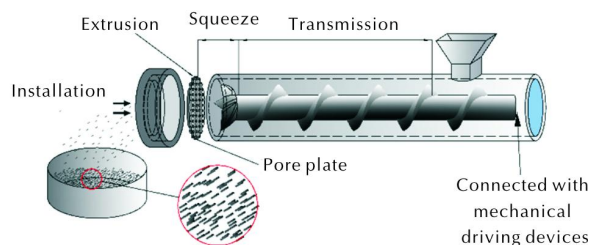
Formation Characteristics of Trumpet-shaped Liner with Large Cone Angle Based on Explosively Formed Penetrator (EFP)

WANG Ya-jun, LI Wei-bing, LI Wen-bin, WANG Xiao-ming, WANG Gui-lin
Chinese Journal of Explosives & Propellants, 2019, 42(5):490-496.



The trumpet-shaped liner with large cone angle was proposed to develop a liner structure suitable for EFP warhead. The difference in collapse process for the horn liner with large cone angle and the traditional arc-cone liner and hemispherical liner was analyzed.

Preparation of Agglomerated Boron Particles by Extrusion-spheronization Method

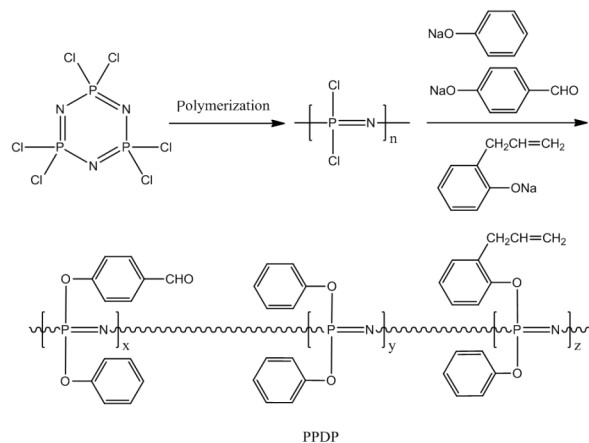


The extrusion-spheronization method was used to prepare the agglomerated boron powder with microcrystalline cellulose (MCC), 3,3-bis (azidomethyl) oxetane and tetrahydrofuran copolyether (PBT) and glycidyl azide polymer (GAP) as binders, respectively. Properties of the agglomerated boron particles, such as morphology, size distribution, bulk density and so on, were also investigated.

ZHANG Huai-long, WU Rui-qiang, XIAO Le-qin, ZHOU Wei-liang, LONG Yi-qiang

Chinese Journal of Explosives & Propellants, 2019, 42(5), 497-503.

Study of Aldehyde/allyl-aryloxypolyphosphazene-based Inhibition Materials for Insertion Solid Propellant (I): Synthesis, Vulcanization Characteristics and Mechanical Properties

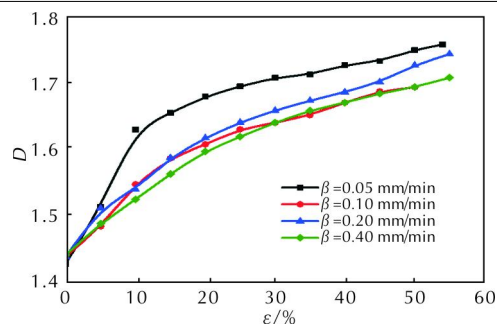


Four aldehyde/allyl-aryloxypolyphosphazenes (PPDP) were synthesized using hexachlorocyclotriphosphazene, phenol, 4-hydroxybenzaldehyde and 2-allylphenol as the starting materials. The polymers were characterized by FT-IR and gel permeation chromatography. The aryloxypolyphosphazene-based inhibition formulas for inserting charge of solid propellant were prepared via compounding and vulcanization. The vulcanization characteristics were analyzed, and their mechanical properties at $+50^{\circ}\text{C}$, -40°C and $+20^{\circ}\text{C}$ were determined via the static strain test and dynamic mechanical thermal analyses.

CAO Ji-ping, XIAO Xiao, WEI Le, ZHAO Feng-qj, YANG Shi-shan

Chinese Journal of Explosives & Propellants, 2019, 42(5), 504-510.

Damage Behavior of GAP Solid Propellant by In-situ Tensile SEM Method

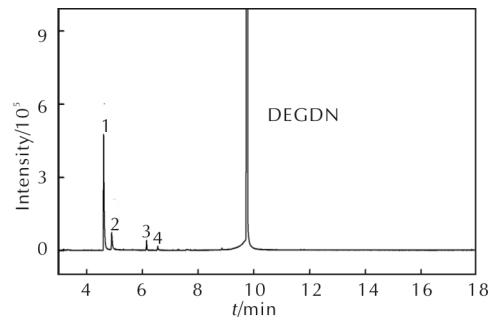


The tensile fracture behavior of GAP solid propellant was observed by in-situ tensile SEM method. The microstructure damage first occurs in the concentrated distribution area of AP particles with large particle size, then the fracture and debonding of small amount of adhesive matrix between adjacent AP particles starts. The effect of different tensile rates on the fracture process was investigated by calculating the fractal dimensions of the images.

YANG Qiu-qiu, CAI Ru-lin, XU Sheng-liang, ZHANG Jian, HUANG Zhi-ping, ZHOU Ming-chuan

Chinese Journal of Explosives & Propellants, 2019, 42(5), 511-515.

Qualitative and Quantitative Analysis of Organic Impurities in Diethylene Glycol Dinitrate

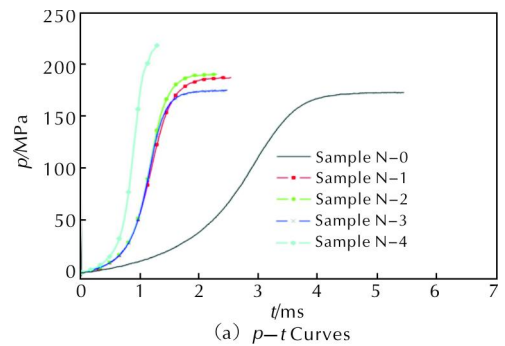


The gas chromatography-tandem mass spectrometric method was established to analyze organic impurities in diethylene glycol dinitrate (DEGDN). The organic impurities in DEGDN were qualitatively and quantitatively determined.

CHEN Shuang, KANG Ying, HU Yin, SUO Zhi-rong, MENG Yu-fu, NING Yan-li

Chinese Journal of Explosives & Propellants, 2019, 42(5), 516-520.

Preparation and Performances of Molded Combustible Cartridge Cases Modified by NGEC



Nitric acid ester of cellulose glycidyl ether (NGEC) was used to replace part of nitrocellulose (NC) or lignocellulose in the formulation, and five combustible cartridge samples were prepared. The mechanical properties and combustion properties were studied.

LI Zhong-shan, TIAN Shu-chun, ZHOU Yi, SHAO Zi-qiang, ZHOU Xiao-hong, YUAN Xiao-li, GUO Bing-yi

Chinese Journal of Explosives & Propellants, 2019, 42(5), 521-525.

Experimental Study on the Thermal Effect of TNT Explosion in Tunnel



Two different qualities of TNT grains were detonated in long and straight tunnel, and the histories of thermal response temperature at different distances from explosion center were obtained by using WRc 5/26 thermocouple.

ZHANG Yu-lei, LI Zhi-rong, ZHANG Jun-feng, PAN Wen, WANG Sheng-qiang

Chinese Journal of Explosives & Propellants, 2019, 42(5), 526-530.