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- ENGCSA : Base sur l'ingénierie dans les nouvelles technologies, le génie civil, l'environnement, les séismes, la mécanique et le transport. Notices en anglais. Base produite par Cambridge Scientific Abstracts (CSA).

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(AEROCSA) AH-2018-2167805427

COMPUTATIONAL STUDY OF HEAT TRANSFER CHARACTERISTICS OF SUPERCRITICAL METHANE FLOW IN THE COOLANT CHANNEL OF A ROCKET ENGINE

Arakkaparambil, M. S.; Kumar, P.; Vaidyanathan, A.

document en anglais

Liquid methane as a rocket fuel has promising prospects for deep space travel in the near future owing to its possible availability in alien planets. The major challenge however appears to be to properly address the issue of unusual heat transfer characteristics observed in the coolant channel at supercritical pressures, typically when the coolant fluid temperatures exceed a critical value. The current work systematically looks at the applicability of typical one-dimensional model to predict the heat transfer behavior in the coolant channel. The study then extends to a 2D numerical analysis and parametric investigation with an objective to study the effect of heat flux on heat transfer at a supercritical pressure. A 2D numerical analysis indicates that the one-dimensional approach is having limited applicability for heat transfer at a supercritical pressure. A systematic study has been carried out in the current work to investigate the onset of heat transfer deterioration in rocket engine coolant channels which involves asymmetric heating. The study indicates that heat transfer deterioration can be expected as the heat flux is increased and interestingly localized flow acceleration owing to sharp fall in density appears to have a prime influence on the heat transfer deterioration. An attempt has been made to look at some possible methods to offset the heat transfer deterioration, and the study reveals that providing higher surface roughness could be a simple possible means to overcome the heat transfer deterioration.

Mots clés : Heat transfer; Deep space; Engine coolants; One dimensional models; Rocket engines; Supercritical pressures; Numerical analysis; Two dimensional analysis; Numerical analysis; Mathematical models; Surface roughness; Heat transfer; Deterioration; Heat flux; Space travel; Methane; Rocket propellants

Journal Article, High Temperature Material Processes ;Begell House Inc, 50 Cross Hwy, Fairfield, Redding, 06896, United States ;VOL. 22; NO. 2/3; PP. 141-; DP. 01 Jan 2018; DOI. 10.1615/HighTempMatProc.2018024725

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(AEROCSA) AH-2018-2167881662

Simulation of GAP/HTPB phase behaviors in plasticizers and its application in composite solid propellant

Song, M.; Du, W.; Luo, Y.

document en anglais

Dissipative particle dynamics and molecular simulations were carried out to investigate the phase behaviors of glycidyl azide polymer (GAP)/hydroxyl-terminated polybutadiene (HTPB) polymer blend in dioctyl sebacate (DOS), and mixture of DOS and bis(2,2-dinitropropyl)formal/acetal (A3), respectively. The rheology of GAP/HTPB propellant slurry plasticized by A3/DOS was studied. First, single-phase aggregations of GAP and HTPB appear slightly in A3/DOS whereas it is conspicuous in DOS, which results from the small surface tension between the GAP/HTPB plasticized by A3/DOS and the weak thermal diffusion of this blend. Furthermore, with the plasticizing ratio (po/pl) increasing to 1.2, the GAP/HTPB propellant slurry plasticized by A3/DOS exhibits small viscosity and yield stress, and the Newtonian-like behavior of slurry improves its manufacturability. Finally, integral GAP/HTPB-based propellant can be obtained using A3/DOS as plasticizers.

Mots clés : Plasticizers; Surface tension; Manufacturability; Glycidyl azide polymer; Polymer blends; Slurries; Rheology; Solid propellants; Energy dissipation; HTPB propellants; Thermal diffusion; Rheological properties; Yield stress

Journal Article, e-Polymers ;Walter de Gruyter GmbH , Genthiner Str. 13, Berlin, 10785, Germany ;VOL. 18; NO. 6; PP. 529-540; DP. 01 Nov 2018; DOI. 10.1515/epoly-2018-0012

(AEROCSA) AH-2018-2168880453

Study on Combustion Performance of HTPB-Based Fuels Containing Aluminum Particles for Hybrid Propellant

Chen, S.-h.; Tang, Y.; Xu, Z.-w.; Zhang, W.; Shen, R.-q.; Ye, Y.-h.

document en anglais

In order to investigate the effects of the aluminum particles on the combustion performance of HTPB-based fuels for hybrid propellant,a transparent combustion chamber experimental system was used in this study. HTPB-based fuel containing different particle size(average size is 100 nm,500 nm and 50m)and different mass fraction(5 wt%,10 wt% and 15 wt%)of aluminum particle respectively weretested and analyzed. The curves of regression rate vs. oxygen mass flux for HTPB-based fuel containing aluminum particles were obtained under the combustion chamber pressure of 1.0 MPa. The results showed that the regression rate of HTPB-based fuel containing aluminum particles increased with the increase of the oxygen mass flux. The regression rate of HTPB-based fuel containing 5 wt% 500 nm aluminum particles was higher than that of HTPB-based fuel containing5 wt% 100 nm and 50m aluminum particles under oxygen flux 250 375 kg/(m2s). The regression rate of HTPBbased fuel containin500 nm aluminum particles increased with the increase of aluminum particle content.

Mots clés : Aluminum; Fuels; Regression analysis; Combustion chambers; Flux; Oxygen; Hybrid propellants; Propellant combustion; Aluminum

Journal Article, Tuijin Jishu = Journal of Propulsion Technology ;China Aerospace Corporation, No.3 Third Research Academy, No.31 Institute, PO Box 7208-26, Beijing, 100074, China ;NO. 6; DP. 01 Jan 2018

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(AEROCSA) AH-2018-2168881270

Time-Temperature Equivalent Research of Nonlinear Viscoelastic Properties of HTPB Propellant

Yi, C.-O. J.; Huang, W.-D.; Li, J.-F.

document en anglais

In order to study the time-temperature equivalent effect of nonlinear viscoelastic properties of HTPB propellant, the time-temperature equivalent theoretical expression of HTPB propellant based on Schapery single-integral nonlinear constitutive equation is derived, and the creep compliance main curve is given. Fitting method. The creep temperature test of HTPB propellant under different stresses (0.1MPa, 0.2MPa, 0.3MPa) and different temperatures (20C, 40C, 60C, 80C), the reference temperature (20C) was obtained. The creep flexibility master curve is analyzed. The effecload change on the creep process is analyzed by repeated loading creep test. The results show that the creep compliance-time logarithmic curve at different temperatures has good stability in the creep stage. The consistency of the time-temperature equivalent effect of the nonlinear viscoelastic properties of HTPB propellant was verified; the time scale of creep compliance main curve under 0.1MPa, 0.2MPa and 0.3MPa stress extended from 103s in test test to 104.27s respectively. , 104.17s and 103.91s; rapid stress release and recovery loading process does not affect the entire creep process, the time-temperature equivalent effect of the load change creep process is continuous.

Mots clés : Propellant tests; Repeated loading; Viscoelasticity; Compliance; Creep tests; Constitutive relationships; Properties (attributes); Viscoelasticity; Curve fitting; Test procedures; Equivalence; HTPB propellants; Constitutive equations

Journal Article, Tuijin Jishu = Journal of Propulsion Technology ;China Aerospace Corporation, No.3 Third Research Academy, No.31 Institute, PO Box 7208-26, Beijing, 100074, China ;VOL. 39; NO. 7; PP. 1643-; DP. 01 Jan 2018

(AEROCSA) AH-2018-2168881380

Application of Digital Holography in 3D Measurement of Aluminum Combustion in Solid Propellant

Jin, B.-n.; Liu, P.-j.; Wang, Z.-x.

document en anglais

In order to obtain the refined process of dynamic combustion of aluminum particles in the solid propellant,the digital holography technique is applied to the three-dimensional dynamic process measurement of aluminum combustion in solid propellant,which solves the problem of the small depth of the traditional optical direct imaging method.A digital holographic measurement system for aluminum combustion in solid propellant is developed,the experiments of the aluminum combustion are carried out under the pressure of 0.1 MPa and1.0 MPa,and the holographic images of the 3 D dynamic combustion process of aluminum particles in propellant combustion are obtained.The results show that the digital holography can obtain the particle information at different space planes,and track the dynamic combustion process of particles,obtain the particle size information accurately and realize the three-dimensional dynamic measurement.The holographic method can clearly distinguish more than ten micron to hundred micron scale aluminum particles in the dynamic combustion process,and the measurement error is less than 8%.After tracking the dynamic process of single aluminum particles,the variation laws of the particle size,space distribution,particle size distribution,combustion flame zone,particle velocity,and the dynamic formation process of the oxidation cap were clearly obtained.The establishment of this method can provide an effective three-dimensional experimental measurement method for studying the dynamic combustion mechanism of aluminum particles in

solid propellant.

Mots clés : Particle size distribution; Aluminum; Digital imaging; Oxidation; Holography; Particle size; Error analysis; Tracking; Spaceplanes; Propellant combustion; Solid propellants; Aluminum

Journal Article, Tuijin Jishu = Journal of Propulsion Technology ;China Aerospace Corporation, No.3 Third Research Academy, No.31 Institute, PO Box 7208-26, Beijing, 100074, China ;VOL. 39; NO. 9; PP. 2102-; DP. 01 Jan 2018

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(AEROCSA) AH-2018-2168882089

Experimental Study on Combustion Characteristic of Rocket Engine Based on Slurry Propellant Containing Aluminum Particles

Shao, A.; Zhu, S.-h.; Xiu-tian-feng, E.; Pan, L.; Zou, J.-j.; Xu, X.

document en anglais

In order to study the combustion characteristics of aluminum-containing slurry propellant, a series of experimental studies were carried out on the slurry propellant model rocket engine. The nano-aluminum powder particles with mass fraction of 21% and aluminum hydride composite particles with mass fraction of 12% were respectively prepared. Adding to JP-10 fuel, the difference in combustion performance between slurry fuel and pure fuel was compared and analyzed. The oxy-combustion ratio of the combustion test was 1.6-2.0. The test results showed that metal particles were added compared with pure JP-10 fuel. The JP-10 slurry fuel has a serious agglomeration effect during atomization and combustion, resulting in a significant reduction in combustion efficiency and mass ratio, while the slurry fuel density is much larger than pure JP-10 fuel, including nanometers. The density of the slurry of aluminum particles is significantly higher than that of pure JP-10 fuel, increasing by 5.5% to 14.6%. The test also found that the ignition delay of the slurry fuel is slightly lower than that of pure JP-10 fuel, metal. The addition of particles has a positive effect on the ignition performance of the propellant. The solid combustion products at the outlet of the nozzle were collected and analyzed by XRD, EDS, SEM, TEM and other means. The oxidation rate of aluminum in the slurry fuel was found to be about For 64 % 74%, particle agglomeration phenomenon is obvious, mainly spherical, uneven size distribution, about 500nm 3m

Mots clés : Nozzles; Fuels; Aluminum hydrides; Metal particles; Combustion products; Particulate composites; Rocket engines; Ignition; Propellant combustion; Slurry propellants; Oxidation rate; Particle size distribution; Aluminum; Atomizing; Agglomeration; Slurries; Density; Rockets; Combustion efficiency

Journal Article, Tuijin Jishu = Journal of Propulsion Technology ;China Aerospace Corporation, No.3 Third Research Academy, No.31 Institute, PO Box 7208-26, Beijing, 100074, China ;VOL. 39; NO. 7; PP. 1650-; DP. 01 Jan 2018

(AEROCSA) AH-2019-2172441002

Study and application of multi-pulse composite perforation technology

document en anglais

The conventional compound perforation cannot meet the development of high-water content, low permeability and heavy oil field. A multi-pulse compound perforation device is developed, which is a high temperature and high-pressure gas produced by two or more different burning rate compound propellant combustion, which is directly applied to the pore through the optimized pressure relief pore structure, and the perforation channel is repeatedly used as a work seam, A new type of perforating device for deep fracturing of strata is obtained by the longer pressure action time. The perforation of the perforating device can effectively improve the production capacity of medium and low permeable reservoir wells.

Mots clés : Perforating; Moisture content; Production capacity; Oil fields; High temperature; Propellant combustion; Burning rate; Porosity; Perforation

Conference Proceedings, DP. 29 Jan 2019; DOI. 10.1063/1.5089104

(AEROCSA) AH-2019-2173674380

Studies on ballistic parameters of di-butyl phthalate-coated triple base propellant used in large caliber artillery gun ammunition

Dahiwale, S.; Bhongale, C.; Roy, S.; Navle, P.; Asthana, S.

document en anglais

Triple base propellant (TBP) containing mainly nitrocellulose, nitroglycerine, and nitroguanidine has been manufactured and coated with plasticizer in the present work. The aim was to study ballistics of di-butyl phthalate (DBP)-coated TBP. DBP solution in ethanol containing nitrocellulose dope was used for coating onto the propellant grains. DBP-deterred propellant showed inhibition to burning, resulting in lowering the values of ballistic parameters namely peak pressure (Pmax), dPmax, pressure index (), and burning rate coefficient ([beta]) during closed vessel firing.Increase in percentage of DBP in coating solution led to further decrease in ballistic parameters. Dynamic evaluation of the surface-moderated propellant showed comparatively lower muzzle velocity and chamber pressure for deterred propellant batches without leaving any unburnt particles in gun chamber at subzero temperatures with the lowest possible charge mass. The DBP-coated propellant can be useful in 155-mm artillery gun to achieve higher loading density as it has lower flame temperature and chamber pressure as compared to uncoated propellant which will result in increasing barrel life due to reduction in the barrel erosion.

Mots clés : Ballistics; Ethanol; Peak pressure; Incineration; Propellant grains; Nitroguanidine; Erosion; Flame temperature; Coating; Parameters; Erosion mechanisms; Ethanol; Cellulose esters; Burning rate; Impact analysis; Cellulose nitrate

Journal Article, Journal of Energetic Materials ;Taylor & Francis Ltd., 2 Park Square, Milton Park, Abingdon, Oxfordshire, OX14 4RN, United Kingdom ;VOL. 37; NO. 1; PP. 98-109; DP. 01 Jan 2019; DOI. 10.1080/07370652.2018.1542467

Gun Propellant System group, High Energy Materials Research Laboratory, Pune, India

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(AEROCSA) AH-2019-2173680030

Silicone bridged iron metallocene butadiene composite solid propellant binder: aspects of thermal decomposition kinetics, pyrolysis and propellant burning rate

Reshmi, S.; Ganesan, M.; Soumyamol, P.; Thomas, D.; Athmaja, D.

document en anglais

Propellant binders are essential components of composite solid propellants (CSP's) used in launch vehicles and missiles. Binders act as a fuel and contribute directly to the combustion in conjunction with oxidizer particles and metallic fuel apart from imparting structural integrity to the solid propellant grain .The performance of CSP's are directly related to the burn rate of the propellant. The burn rates of the ammonium perchlorate (AP) propellants are generally moderated using various types of transition metal oxide (TMO) catalysts. However, TMO's are associated with inherently large dispersions in propellant burn rates and compromise on energetics. One of the most suitable methods for achieving lower dispersion in burn rate is using binders wherein a burn rate catalyst is grafted to the polymer matrix. In the present paper, the thermal decomposition of ferrocene bound hydroxyl terminated polybutadiene (FC-Si-HTPB) grafted to butadiene backbone via hydrosilylation was investigated The thermal degradation mechanism, stability and its effectiveness as burn rate catalyst are the most important aspects for use in CSP's. The mechanism of decomposition of the neat resin and in combination with AP has been elucidated using pyrolysis gas chromatography-mass spectrometric technique (GC-MS). FC-Si-HTPB exhibits single stage decomposition in the temperature range of 263-491C. The decomposition of FC-Si-HTPB with AP oxidizer follows a two stage mechanism in the 195-490C.The char residue was characterized using FTIR, Ramaspectroscopy and FE-SEM analysis, which enables to vindicate the mechanism of reaction. The activation energy for the decomposition of HTPB is 283.6 kJ/mol, FC-Si-HTPB is 251.5 kJ/mol and for Fc-Si-HTPB-AP system is 67.1 kJ/mol. The major pyrolysis products of neat FC-Si-HTPB are ferrocenyl derivatives, silylated ferrocenyl derivatives and precursors emanating from polybutadiene backbone. The propellants based on the new binder exhibited an increase in burn rate with iron content and higher fine content. A comparison of propellant burn rate with conventional micron sized ferric oxide exhibited an improvement of 34%.Based on the thermal analysis studies, the thermal endurance of the system was computed to be FC-HTPBü HTPBü FC-HTPB-AP.

Mots clés : Combustion; Fourier transformation; Binders; Ammonium; Decomposition reactions; Kinetics; Catalysts; Thermal resistance; Iron; Decomposition; Catalysis; Backbone; Transition metals; Raman spectroscopy; Thermal decomposition; Missiles; Propellant binders; Thermal analysis; Silicon; Propellants; Pyrolysis; Thermal analysis; Incineration; Gas chromatography; Propellant grains; Endurance; Solid propellants; Perchlorate; Gas chromatography; Thermal decomposition; Fatigue tests; Decomposition; Composite materials; Ammonium perchlorates; Butadiene; Pyrolysis; Burning rate; Derivatives; Reaction kinetics; Catalysts

Journal Article, Journal of Energetic Materials ;Taylor & Francis Ltd., 2 Park Square, Milton Park, Abingdon, Oxfordshire, OX14 4RN, United Kingdom ;VOL. 37; NO. 1; PP. 12-28; DP. 01 Jan 2019; DOI. 10.1080/07370652.2018.1517397

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(COPLUS) E2018-4806162559

Synthesis and thermal performance study of C60-polyglycidyl nitrate (C60-PGN) maleic acid copolymer lead salts

Chai Z.; Jin B.; Gong W.; Peng R.; Chu S.

document en anglais

2018, 2018 Taylor & Francis Group, LLC. A C60-polyglycidyl nitrate (C60-PGN) maleic acid copolymer lead salt was synthesized through two steps using C60-PGN, maleic acid, and lead nitrateraw materials. The synthesized product was characterized by Fourier transform infrared, X-ray diffraction, X-ray photoelectron spectroscopy. The thermal stability of the C60-PGN maleic acid copolymer lead salts was investigated by differential thermal analysis and thermogravimetric analysis. The results showed that it exhibited good resistance to thermal decomposition at 546.93 K. The thermal decomposition kinetic parameters of the C60-PGN maleic acid copolymer lead salts are also obtained through the Kissinger and Ozawa-Doyle methods, with Ea = 166.31 and 166.99 kJ mol1, respectively. Moreover, C60-PGN maleic acid copolymer lead salts exhibited high catalytic activity for the thermal decomposition of HMX, indicating that the salt can be used as a combustion catalyst in solid propellants.

Mots clés : Lead compounds*; Catalyst activity; Decomposition; Differential thermal analysis; Explosives; Nitrates; Salts; Solid propellants; Thermodynamic stability; Thermogravimetric analysis; Thermolysis; X ray photoelectron spectroscopy ;Combustion catalyst; Energetic catalytic; Fourier transform infra reds; Lead nitrates; Lead salts; Maleic acid copolymers; Thermal decomposition kinetics; Thermal Performance

Journal Article, Fullerenes Nanotubes and Carbon Nanostructures ;Taylor and Francis Inc. ;VOL. 26; NO. 12; PP. 880-886; 35 Ref.; DP. December 2018;

State Key Laboratory of Environment-friendly Energy Materials & School of Material Science, Engineering Southwest University of Science and Technology, Mianyang, Sichuan, China State Key Laboratory of Environment-friendly Energy Materials & School of Material Science, Engineering Southwest University of Science and Technology

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(COPLUS) E2019-0106327186

Solid rocket motors internal ballistic model with erosive and condensed phase considerations

Mingireanu F.; Jula N.; Miclos S.; Savastru D.; Baschir L.

document en anglais

2018, Politechnica University of Bucharest. All rights reserved. An interior ballistics model was implemented and applied for a double base and composite propellant boosters to be used for boosted dart suborbital vehicle. Erosion and condensed phase are taken into account and numerical results are shown in comparison with experimental data obtained on test firings for each motor. Fast calculation of the main parameters of the solid rocket motor unit (thrust, burn time, specific impulse, total impulse) is available. The solid fuel characteristics and motor geometry are contained within two input files while the results of the calculations are presented to the user in a several output files.

Mots clés : Composite propellants*; Ballistics; Composite materials; Fuels; Numerical analysis; Propulsion; Rocket engines; Rockets ;Aerospace; Fast calculations; Interior ballistic; Internal ballistic; Numerical results; Solid rocket motors; Specific impulse; Suborbital vehicle ;404.1; 654.1; 654.2; 921.6; 951

Journal Article, UPB Scientific Bulletin, Series A: Applied Mathematics and Physics ;Politechnica University of Bucharest ;VOL. 80; NO. 4; PP. 255-266; 30 Ref.; DP. January 2018;

Romanian Space Agency ROSA, Romania Romanian Space Agency ROSA

(COPLUS) E2019-0306396672

Ferrocene grafted hydroxyl terminated polybutadiene: A binder for propellant with improved burn rate

Rao B.N.; Malkappa K.; Jana T.; Kumar N.

document en anglais

2019 Elsevier Ltd In this work, iron containing hydroxyl terminated polybutadiene (Fe-HTPB) based binder cum burn rate catalyst has been developed without altering the crucial physical propertieof HTPB. Ferrocene, the source of Fe in the Fe-HTPB, has been grafted at the terminal carbons of HTPB to ensure no alternation in microstructure of HTPB which in turn helped in retaining physical properties of pristine HTPB. The structure and the presence of ferrocene as the end cap groups of the Fe-HTPB were confirmed by solid-state NMR and MALDI-TOF-MS analysis. Control over the viscosity and Fe content of the Fe-HTPB was achieved by varying the grafting reaction recipes and conditions. The Fe content, as measured by inductively coupled plasma - atomic emission spectroscopy (ICP-AES) in the Fe-HTPB varied from 0.06% to 0.165% (by weight) and found to be responsible for increasing viscosity of Fe-HTPB from 5857 mPa S to 11,890 mPa S. Non aluminized composite solid propellants (CSPs) with 86% (wt%) ammonium perchlorate loading were prepared using Fe-HTPB as a binder for studying the burn rate efficiency. Burn rates of CSPs made from Fe-HTPB binders were found to be enhanced by 125% compared to CSPs of pristine HTPB. At 40 bar pressure, the burn rate of CSPs made from Fe-HTPB and pristine HTPB binders are 20.56 and 9.07 mm/s burn rate, respectively. In addition, all the CSPs made from Fe-HTPB were found to be very stable as their pressure index is less than 0.5.

Mots clés : HTPB propellants*; Atomic emission spectroscopy; Binders; Composite propellants; Grafting (chemical); Inductively coupled plasma; Inorganic compounds; Iron; Iron compounds; Microstructure; Nuclear magnetic resonance spectroscopy; Organometallics; Polybutadienes; Polyols; Viscosity ;Ammonium perchlorates; Burn rates; Composite solid propellant; Ferrocenes; Hydroxyl terminated polybutadienes; Inductively coupled plasma atomic emission spectroscopy; MALDI-TOF-MS analysis; Propellant binders ;545.1; 631.1; 802.2; 803; 804; 815.1.1; 932.3; 951

Journal Article, Polymer ;Elsevier Ltd ;VOL. 163; PP. 162-170; 43 Ref.; DP. February 2019;

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