Soviet Aerospace Literature

This month: *Propellants and Fuels*

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A86-35476 Chemistry and technology of oil and fuel additives (2nd enlarged and revised edition) (Russian book) (Khimiia i tekhnologiia prisadok k maslam i toplivam). A. M. KULIEV, *Leningrad, Izdatel'stvo Khimiia,* 1985, 312 pp. 338 refs.

Basic functional requirements, chemical composition, and properties of various fuel and oil additives are discussed. Special attention is given to motor oil additives having antioxidant, anticorrosion, and dispersing properties, as well as to viscous additives and solidification depressants, and to methods of motor oil indexing and testing. Technological processes for production of sulfonate-based (e.g., SB-3 and PMS), alkylphenol-based (e.g., ZIATIM-339, BFK, and IKhP-101), S- and P-containing (e.g., VNII NP-360, EFO, and IKhP-388), polyisobutylene, and polymethacrylate (e.g., AKOR-1 and AFK) motor oil additives are described in detail. In addition, the synthesis and properties of fuel additives, including compounds with antioxidant, dispersing, anticorrosion, antismoke, and antisoot properties are discussed. Numerous production schemes are included.

A85-39101 The "solution-large molecules" method for calculating the equilibrium composition of heterogeneous systems (Metod "rastvor-bol'shie molekuly" dlia rascheta ravnovesnogo sostava geterogennykh sistem). V. E. ALEMASOV, Z. KH. GRUZDEVA, A. A. DREGALIN, and A. F. DREGALIN, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1985, pp. 6-9.

A refined method for calculating the equilibrium composition of heterogeneous systems is presented which combines the advantages of the large-molecule method and of the model of an ideal solution of condensed phases. It is shown that the new method provides better convergence and requires less computational effort than either of the above approaches. Results are presented for the combustion products of O2 + BeH2 fuel.

A85-46227 Spherical shell explosion in a fuel mixture leading to multiple-front detonation combustion (Vzryv sfericheskoi obolochki v goriuchei smesi s obrazovaniem mnogofrontovogo detonatsionnogo goreniia). A. A. AFANASEV and V. A. LEVIN, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, May-June 1985, pp. 87-92. 17 refs.

The paper is concerned with the dual-front detonation combustion resulting from the explosion of a charge in the form of a spherically symmetric shell. In particular, it is shown which of the possible self-similar combustion modes is realized with time, depending on the explosive charge energy and heat release in each of the waves. The interaction between the waves is also discussed.

A86-49304 Numerical modeling of the mixing of gas jets with allowance for chemical nonequilibrium (Chislennoe modelirovanie smesheniia gazovykh strui s uchetom khimicheskoi neravnovesnosti). SH. KH. ZARIPOV, A. A. ILIUSHIN, and L. M. KOTLIAR, IN: Mathematical modeling in physical gas dynamics (A86-49301 24-36), *Kazan, Izdatel'stvo Kazanskogo Universiteta,* 1985, pp. 19-26. 14 refs.

The numerical modeling of the mixing of chemically reactive gas jets is considered for the example of the supersonic diffusion flow of periodically pulsed jets of H2 fuel with oxidizer and diluent. The flow is investigated on the basis of boundary layer equations and a quassi-one-dimensional flame-front model. Methods for calculating the kinetics and determining the pressure gradient are proposed. Results obtained with the two approaches agree well.

86-49963 The effect of the monoethers of dicarboxylic acids on the antiwear properties of jet fuels (Vliianie monoefirov dikarbonovykh kislot na protivoiznosnye svoistva reaktivnykh topliv). A. S. KISLENKO, I. F. KRYLOV, G. I. SOKOLOVA, V. P. SEREGIN, and G. B. SKOVORODIN (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlenosti, Moscow, USSR), *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 6, 1986, pp.16-18. 7 refs.

Experimental data are presented on the effect of the addition of synthetic monoethers of dicarboxylic acids in amounts of 0.004-0.07% (by mass) on the antiwear properties of hydrorefined jet fuels. It is found that the antiwear effect of these additives is largely determined by their structure. In particular, the effectiveness of the monoethers as antiwear additives increases with the decreasing number of methylene groups contained between the functional groups of the dicarboxylic acids and with the decreasing length of the alcohol hydrocarbon radical.

A85-46221 Combustion efficiency of a hydrogen-kerosene fuel in a straight-through channel (Effektivnost' goreniia vodorodokerosinovogo topliva v priamotochnom kanale). IU. M. ANNUSHKIN and G. F. MASLOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, May-June 1985, pp. 30-32. 5 refs.

Results of an experimental study of the combustion efficiency of a composite hydrogen-kerosene fuel in a straight-through channel are reported. It is shown that the completeness of the combustion of the composite fuel has a maximum depending on the relative content of hydrogen in the fuel. The position of the maximum is determined by the coefficient of excess air in the combustion chamber and by the general combustion efficiency of the fuel.

A85-39965 The effect of reduced pressure and water addition on the combustion of an ammonium nitrate-potassium bichromate mixture (O vliianii ponizhennogo davleniia i dobavki vody na gorenie smesi nitrata ammoniia s bikhromatom kaliia). A. A. SHIDLOVSKII and V. V. GORBUNOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Mar.-Apr. 1985, pp. 57-59.

The combustion of a 90 pct NH4NO3 + 10 pct K2Cr2O7 mixture under reduced pressure, with 5, 10, or 12% H2O added to the mixture, is investigated in order to gain a better understanding of the processes occurring in the gas phase. It is found that both a reduction in pressure and the addition of water lead to a reducton in the combustion rate and combustion temperature and an increase in the critical diameter of combustion. The minimum pressure required for the stable combustion of a 20-mm-diameter charge is 40 kPa. As the pressure is reduced from 98.1 to 40 kPa, the combustion temperature decreases from 693 to 609 K. Stable combustion is observed with a maximum water content of 12%; the combustion temperature in this case decreases to 598 K.

A86-43420 Effect of different hydrogen-injection techniques on its burnup in a supersonic air flow (Vliianie razlichnykh sposobov podachi vodoroda na ego vygoranie v sverkhzvukovom potoke vozdukha). V. A. ZABAIKIN and A. M. LAZAREV (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR), *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), March 1986, pp. 44-49. 11 refs.

The technique used to inject a gaseous fuel into a supersonic oxidizer flow has an important effect on flow pressure losses, flame stabilization, and combustion efficiency during supersonic combustion. In the present study, an experiment was conducted to measure hydrogen combustion efficiency for different injection techniques at a temperature of the supersonic air flow above 1000 K. Three types of injectors were considered: straight-flow, vortex-type, and a device yielding a fan of perpendicular jets. The data confirm the decisive role of the injection method and the wave structure of the jets on combustion efficiency in a hydrogen flame.

A85-46219 A study of the agglomeration of aluminum particles during combustion as part of condensed mixture systems (Issledovanie aglomeratsii chastits aliuminiia pri gorenii v sostave smesevykh kondensirovannykh sistem). V. A. BABUK, V. P. BELOV, V. V. KHODOSOV, and G. G. SHELUKHIN, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, May-June 1985, pp. 20-25. 6 refs.

The agglomeration of aluminum particles during the combustion of aluminum-containing condensed mixtures is investigated experimentally in the pressure range 0.1-7.0 MPa. The pressure dependence of the agglomerate dispersity and the effect of the system structure on the agglomeration process are determined for various mixture compositions. Three distinct agglomeration mechanisms associated with the combustion of aluminum-containing mixtures are identified.

A86-29171 Corrosion of a silicon nitride ceramic in a stream of fuel combustion products (Korroziia keramiki na osnove nitrida kremniia v potoke produktov sgoraniia topliva). IU. G. GOGOTSI, V. V. SHVAIKO, V. A. LAVRENKO, N. N. ZUDIN, and V. V. KOVYLIAEV (Kievskii Politechnicheskii Institut, Kiev, Ukrainian SSR) et al., *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 286, No. 4, 1986, pp. 901-903. 8 refs.

The effect of corrosion in the combustion products of kerosene on the composition and structure of the surface layer of a reaction-sintered silicon nitride ceramic (Si3N4 - 30 pct SiC - 2 pct MgO) is investigated experimentally at 1250 and 1370 C. It is found that high-temperature corrosion in the combustion products produces significant changes in the surface morphology and leads to the formation of an oxide layer whose composition and structure are different from those of an oxide layer formed in air. It is emphasized that in order to obtain reliable estimates of the material performance, tests must be conducted under conditions similar to the actual operating conditions.

A86-12555 High-speed laser photorecording of a fuel nozzle jet (Lazernaia skorostnaia fotoregistratsiia fakela forsunki). V. P. SHORIN, O. A. ZHURAVLEV, L. N. MEDINSKAIA, A. G. OSADCHUK, and V. V. TOKAREV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 2, 1985, pp. 100-102. 6 refs.

The existing methods of monitoring the structure of a fuel jet injected into the combustion chamber of a gas-turbine engine are briefly reviewed, and the advantages of high-speed laser photorecording (the laser knife method) are examined. This method makes it possible to visualize the structure of the jet and to determine the velocity distributions of gas flow by injecting monodisperse particles with specified optical properties. Experimental results for a fuel jet injected by a pneumatic nozzle are presented which show that reliable recording of the jet structure is achieved with an energy density in the laser knife of 250 J/sq m, which can be provided by an unamplified ruby laser.

A87-10408 Convective combustion in a deformable solid fuel with longitudinal channels (Rezhim konvektivnogo goreniia v deformiruemom tverdom toplive s prodol'nymi kanalami). N. N. SMIRNOV and I. D. DIMITRIENKO, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 22, May-June 1986, pp. 59-67. 23 refs.

A theoretical model is proposed for nonstationary propagation of a convective flame front in channels in a deformable solid fuel. The full surface inside the channels is ignited as a result of the penetration of hot reaction products. A method is proposed for the numerical integration of a system of equations of nonstationary one-dimensional gas flow and equations of motion for the deformable solid fuel, with allowance made for interphase friction, heat and mass transfer, and chemical reactions.

A86-32347 Theoretical fundamentals of the chemistry of fuels and lubricants [Russian book] (Teoreticheskie osnovy khimmotologii). A. A. BRATKOVA, (ed.), *Moscow, Izdatel'stvo Khimiia,* 1985, 320 pp. No individual items are abstracted in this volume.

The theory and methods of the chemistry of fuels and lubricants, treated here as a separate scientific discipline, are reviewed in a systematic manner. In particular, attention is given to the theory of the oxidation of liquid hydrocarbons, the evaporation and combustion of liquid fuels, the theory of surface phenomena in engines and mechanisms involving surfactants, and the theory of friction and wear. The discussion also covers the theoretical fundamentals of the corrosion protection of metals in fuels and lubricants and the mechanisms underlying the protective action of corrosion inhibitors.

A85-46223 The effect of temperature and velocity inhomogeneities on the flame stabilization limits of premixed fuel-air mixtures (Vliianie temperaturnoi i skorostnoi neodnorodnostei na predely stabilizatsii plameni predvaritel'no podgotovlennykh toplivovozdushnykh smesei). V. N. GRUZDEV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, May-June 1985, pp. 42-45. 7 refs.

Experimental data are presented on the flame stabilization limits of premixed fuel-air mixtures as a function of the temperature and velocity inhomogeneities of the incoming flow. It is found that a temperature inhomogeneity longitudinal with respect to a two-dimensional stabilizer expands the flame stabilization limits of the mixtures, whereas a velocity inhomogeneity has the opposite effect.

A85-46244 The effect of vibrocaviation on the physicochemical properties of fuel in the systems of flight vehicles (Vliianie vibrokavitatsii na fiziko-khimicheskie svoistva topliva v sistemakh letatel'nykh apparatov). P. P. MERTSALOV, B. G. BEDRIK, and K. L. SUPONKO, *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 7, 1985, pp. 23-25. 8 refs.

The conditions giving rise to vibrocaviation in the fuel of a flight vehicle during flight and the factors contributing to the onset of microcaviation are examined. With reference to experimental data for TS-1 and T-6 fuels, it is shown that microcaviation affects the granulometric composition, viscosity, resin content, and thermal oxidation stability of the fuels, whereas other properties remain unchanged. The importance of allowing for the effect of vibrocaviation on the physicochemical properties of fuels during tests and flight operations and also during the development of requirements for new fuels is emphasized.

A86-19292 A study of high-frequency vibrations in a fuel flow control system (Issledovanie vysokochastotnykh kolebanii v sisteme regulirovaniia raskhoda topliva). B. S. DROBIAZKO, IN: Hydrogasdynamics of technical systems (A86-19291 07-02), *Kiev, Izdatel'stvo Naukova Dumka,* 1985, pp. 87-92.

A mathematical model describing high-frequency self-oscillations in the fuel flow control system of a jet engine is proposed. The model is based on a flow rate feedback mechanism and wave oscillations of the liquid fuel in flow-controlling fuel lines. The calculated frequencies of the self-oscillations are found to be in good agreement with experimental data. The results of the study have been used to develop a simple and efficient method whereby auto-oscillation suppression is achieved by adjusting the natural frequencies of throttle tubes.

A86-19293 A study of the effect of the fuel mixture feed pressure on the maximum combustion chamber pressure during pulsating combustion (Issledovanie vliianiia davleniia podachi toplivnoi smesi na maksimal'noe davlenie v kamere sgoraniia pri pul'satsionnom rezhime goreniia). A. G. GOLOVACH, IN: Hydrogasdynamics of technical systems (A86-19291 07-02), *Kiev, Izdatel'stvo Naukova Dumka,* 1985, pp. 93-98. 8 refs.

The process of pulsating combustion is investigated analytically. Equations are obtained which relate the maximum pressure in a combustion chamber under conditions of pulsating combustion to the fuel mixture feed pressure; a theoretical curve of combustion temperature vs fuel feed pressure is presented. It is shown that the efficiency of combustion can be increased by increasing the fuel mixture feed pressure and, consequently, the pressure and temperature of a pulsating combustion chamber.

A85-26279 Stabilizing T-6 fuel with antioxidant mixtures (Stabilizatsiia topliva T-6 smesiami antiokislitelei). I. A. GOLUBEVA, T. P. VISHNIAKOVA, T. V. POPOVA, and L. P. GUTNIKOVA, (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR), *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 1, 1985, pp.16-17. 5 refs.

Antioxidant mixtures based on N,N'-di (3,5-di-tert-butyl-4-oxybenzyl) urea (additive KF-1) were investigated to determine their stabilizing effect on T-6 jet fuel. To determine the efficiency of the antioxidant mixtures, fuel samples were repeatedly (12 times) heated at 120 C; the acidity of the fuel, its optical density, and its peroxide number were determined at the end of each test. A synergistic effect was observed for mixtures based on KF-1 with diethylene glycol ether and with other phenosanes. This effect is ascribed to the oxidation inhibiting action of the reaction products of the initial antioxidants.

A86-27107 An experimental study of the fine structure of a turbulent diffuse flame of an automized liquid fuel (Eksperimental'noe issledovanie tonkoi struktury turbulentnogo diffuzionnog fakela raspylennogo zhidkogo topliva). S. I. BARANOVSKII, V. P. NIKOLENKO, and A. I. TURISHCHEV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Nov.-Dec. 1985, pp.14-19. 7 refs.

Results of a comprehensive study of a turbulent flame of an automized liquid fuel are presented. In particular, the results contain optical measurements of the relative amplitude of temperature fluctuations which can be used, in a qualitative analysis, as an analogy of the intensity of turbulent temperature fluctuations. Data are also presented on the mean droplet size, the volume concentration of the liquid phase, and the average gas temperature and its chemical composition.

A86-27108 Modeling of flow of the combustion products of hydrocarbon fuels in an impulsive wind tunnel of the explosive type (Modelirovanie techenii produktov sgoraniia uglerodnykh topliv v impul'snoi ustanovke vzryvnogo tipa). A. B. BRITAN, V. A. LEVIN, G. D. SMEKHOV, A. M. STARIK, and IU. V. TUNIK, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Nov.-Dec. 1985, pp. 34-41. 19 refs.

Results of study of the inverse characteristics of the combustion products of acetylene-air fuels with up to 40% molecular oxygen are presented. In particular, attention is given to methods of modeling vibrationally nonequilibrium flows in an impulsive wind tunnel of the explosive type, combustion characteristics, and quality of supersonic flow. Experimentally determined values of the optical gain coefficient are compared with analytical results.

A86-16750 The temperature dependence of the electrical conductivity of jet fuels with antistatic additives (Zavisimost' elektroprovodimosti reaktivnykh topliv s antistaticheskimi prisadkami ot temperatury). A. I. BELOUSOV and E. M. BUSHUEVA, (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Neftianoi Promyshlennost', Moscow, USSR), *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 10, 1985, pp. 26-28. 5 refs.

A study is made of the temperature dependence of the electrical conductivity of jet fuels with Soviet-made (Sigbal and ASP-1) and foreign (ASA-3 and Kerostat) antistatic additives. An analysis of the results obtained shows that the change of the electrical conductivity of such fuels with temperature is largely determined by the additive. The smallest change of electrical conductivity (1.3% per 1 C) is observed for fuels containing the antistatic additive Sigbol.

A85-33182 Gasdynamic effects during the self-ignition of an atomized liquid fuel (Gazodinamicheskie effekty pri samovosplamenenii raspylennogo zhidkogo topliva). A. A. BORISOV, B. E. GELFAND, S. A. TSYGANOV, and E. I. TIMOFEEV (Akademiia Nauk SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR), *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 281, No. 2, 1985, pp. 361-363. 9 refs.

It is shown experimentally that the ignition of an atomized low-volatility fuel within a closed air volume can be promoted not only by chemical additives but also by gasdynamic techniques. The gasdynamic promotion of ignition is achieved as a result of improved fuel mixing due to secondary gasdynamic motions. The example presented here involves the self-ignition of an atomized liquid fuel behind reflected shock waves near the end of a shock tube.

A86-43386 Catastrophic breakup of liquid jets in a subsonic transverse gas flow (Katastroficheskoe razrushenie strui zhidkosti v dozvukovom snosiashchem potoke gaza). M. E. RUDIAK, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1986, pp. 42-46. 13 refs.

An electric-contact method is used to study the catastrophic breakup of liquid jets in a subsonic transverse gas flow, with reference to the pneumatic atomization of liquid fuels. The special conditions of gas-liquid interaction are shown to determine the considerable increase in the breakup rate. It is recommended that catastrophic breakup be used to improve the operation of gas-liquid fuel mixers.

A86-18966 Convective combustion in channels and cracks in solid fuel (Konvektivnoe gorenie v kanalakh i treshchinakh v tverdom toplive). N. N. SMIRNOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Sept.-Oct. 1985, pp. 29-36. 22 refs.

A theoretical model is presented which describes the unsteady propagation of a convective ignition front along the surface of a cylindrical channel in solid fuel. Convective combustion is initiated by reaction products entering the channel due to a pressure gradient. Changes in the convective combustion rate along the channel, pressure distribution, and maximum pressure in the channel are determined by numerically integrating equations of unsteady one-dimensional gas flow with allowance for wall friction, heat and mass transfer, and chemical reactions at the interface.

A86-13675 The structure of soot particles in the flame during the jet combustion of liquid fuels in a straight-flow combustion chamber (Struktura sazhevykh chastits v plameni pri fakel'nom szhiganii zhidkogo topliva v priamotochnoi kamere sgoraniia). M. V. STRADOMSKII, E. A. MAKSIMOV, E. A. EFREMOVA, and V. I. KOZLENKO (AN USSR, Institut Tekhnicheskoi Teplofiziki, Kiev, Ukrainia SSR) *Promyshlennaia Teplotekhnika* (ISSN 0204-3602), Vol. 7, No. 4, 1985, pp. 75-78. 5 refs.

The size and structure of soot particles in the flame during the combustion of an automized liquid hydrocarbon fuel of the TS-1 type were investigated for various excess air ratios. During the experiments, a special device was used to obtain soot samples directly from the flame without disturbing the structure of the particles. Microphotographs and X-ray diffractograms show that the soot particles are clusters of 7-17-mm-diameter spherical particles.

A85-50100 The effect of the fractional composition on the quality characteristics of jet fuel (Vliianie frakttsionnogo sostava na pokazateli kachestva reaktivnogo topliva). A. F. GORENKOV, T. A. LIFANOVA, and I. G. KLIUIKO, *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 8, 1985, pp. 37-39.

An experimental study was carried out in which fractions with different boiling temperatures (in the range 60-300 C) were distilled from a mixture of West Siberian oils. The initial temperature of crystallization, aromatic hydrocarbon contents, lower combustion heat, and flash point of these fractions were determined using standard methods. These quantities were then plotted as a function of the initial and final boiling temperatures, and the corresponding analytical expressions were obtained. An analysis of the experimental data shows that the properties of jet fuels are closely correlated with the fractional composition over the temperature range 60-300 C.

A85-31518 The effect of concentration fluctuations on the ignition of a wall set of hydrogen in supersonic flow (Vliianie pul'satsii kontsentratsii na vosplamenenie pristennoi strui vodoroda v sverkhzvukovom potoke). O. M. KOLESNIKOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Jan.-Feb. 1985, pp. 53-58. 10 refs.

The ignition and combustion of a turbulent wall jet of hydrogen issuing into a supersonic air slipstream is investigated by solving parabolized Navier-Stokes equations using a marching numerical integration procedure. The results obtained are compared with experimental data in the literature. It is shown that the observed pressure increase can be correctly predicted only when allowance is made for the effect of concentration fluctuations on the chemical reaction rates.

A86-36463 Chemical reactions and heat and mass transfer in a multicomponent gas above a liquid-fuel layer (Khimicheskie reaktsii i teplomassoperenos v mnogokomponentnom gaze nad sloem zhidkogo goriuchego). N. N. SMIRNOV, *Moskovskii Universitet, Vestnik, Seriia 1 - Matematika, Mekhanika* (ISSN 0579-9368), Mar.-Apr. 1986, pp. 46-55. 17 refs.

The flow of a chemically reactive gas mixture above a thermally decomposing liquid-fuel surface is studied theoretically. Attention is given to the combustion of a fuel at rest in an oxidizer flow, and to a boundary layer with chemical reactions behind a shock wave sliding over the fuel layer. Distributions of velocity, temperature, and concentration in the liquid and gaseous phases are obtained, and the mass rate of burnout of the fuel surface is determined. The combustion of ethyl alcohol in air is considered as an example.

A85-39962 Using the Burke-Schumann solution for the diffusion flame to describe the combustion of condensed substances (Ob izpol'zovanii resheniia Burke-Shumana dlia diffuzionnogo plameni pri opisanii goreniia kondensirovannykh veshchestv). L. K. GUSACHENKO, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 21, Mar.-Apr. 1985, pp. 41-45. 7 refs.

It is shown that the well-known Beckstead-Derr-Price model describing the combustion of heterogeneous solid fuels employs a modified Burke-Schumann solution satisfying, on the combustion surface, a boundary condition that is valid only for the particular case of "long flames." It is further shown in what way the adoption of a more general boundary condition can affect the flame pattern near an oxidizer crystal.

A87-10410 The effect of the addition of carbon and boron nitride on the detonation of high explosives (Vliianie dobavok ugleroda i nitrida bora na detonatsiiu vv). S. V. PIATERNEV, S. V. PERSHIN, A. N. DREMIN, and A. I. ANISKIN, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 22, May-June 1986, pp. 99-103. 15 refs.

Experimental curves describing the dependence of the detonation velocity on the initial density of mixtures of graphite and boron nitride with high explosives are found to have singularities due to the effect of the polymorphic transformation of the additive on the detonation process. It is shown that the main factors responsible for this effect are a reduction in volume and changes in the thermodynamic properties of the additive with the transition to a new polymorphic modification.

A87-10613 Shock-wave propagation in air during the explosion of a gaseous charge (Rasprostranenie udarnoi volny v vozdukhe pri vzryve gazovogo zariada). E. A. ASHRATOV, U. G. PIRUMOV, and V. V. SURKOV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), May-June 1986, pp. 110-118. 14 refs.

A theoretical analysis is made of the propagation of a shock wave in air due to the explosion of a spherical or cylindrical charge. In the range of specific charge energy characteristic for fuel-air explosives, a numerical solution is obtained using the method of characteristics without the isolation of secondary shock waves. The effect of the initial explosion conditions (specific energy, initiation characteristics, etc.) is analyzed, and a comparison is made with the case of a point explosion with regard to the pressure difference on the shock wave and the impulse of positive excess pressure.

A87-10402 A solution to the ignition problem for condensed systems based on a difference scheme with a time-varying computational grid (Reshenie zadachi zazhiganiia kondensirovannykh sistem na osnove raznostnoi skhemy s meniaiushcheisia vo vremeni raschetnoi setkoi). I. G. BOROVSKOI, S. S. BONDARCHUK, E. A. KOZLOV, and V. N. VILIUNOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 22, May-June 1986, pp.14-18. 6 refs.

A difference scheme with a computational grid varying as a function of heating conditions has been developed for solving a class of problems modeling rapid physical processes including the ignition of condensed systems. The efficiency of the difference scheme proposed here in solving the ignition problem with allowance for the chemical transformation of the original substance is demonstrated. As an example, the scheme is used to investigate the effect of the ambient medium parameters and burnout on the ignition time of a gunpowder.

A85-44199 The combustion mechanism of disperse fuel systems (O mekhanizme goreniia dispersnykh toplivnykh sistem). V. M. IVANOV, I. V. RADOVITSKII and V. A. TSENEV (Institut Goriuchikh Iskopaemykh; Vsesoiuznyi Zaochnyi Politekhnicheskii Institut, Moscow, USSR), *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 6, 1985, pp.18-20. 9 refs.

A comprehensive experimental study including high-speed filming has shown that the combustion of disperse fuel systems, with the disperse phase consisting of polar liquids or their mixtures, is essentially different from that of pure liquid fuels. When introduced into air heated to 700 C or higher, droplets of fuel emulsions of the water-fuel type are rapidly heated, increase in volume, and burst. This phenomenon, referred to as microexplosion or inter-combustion-chamber fractionation, is characteristic of all fuel emulsions containing polar liquids (e.g. water, methanol, and ethanol), including gasoline and three-component disperse fuel systems, i.e., hydrocarbon-mazut suspensions. The physical mechanism of the microexplosion is examined, and the practical advantages of using fuel emulsions and suspensions are discussed.

A86-36674 Calculations of turbulent jets of a reacting gas with allowance for combustion product recirculation (K raschetu turbulentnykh strui eagiruiushchego gaza s uchetom retsirkuliatsii produktami goreniia). Z. SH. ZHUMAEV, I. K. KHUZHAEV, M. SH. TURDYEV, and A. A. ABRAMOV (AN USSR, Institut Mekhaniki i Sesmostoikosti Sooruzhenii, Tashkent, Uzbek SSR), *Akademiia Nauk Uzbekskoi SSR, Doklady* (ISSN 0134-4307), No. 12, 1985, pp.13-15.

Equations for the turbulent boundary layer of a multicomponent reacting gas are used to describe the turbulent motion of nonmixed combustible gases issuing from a round nozzle and propagating in an air-flooded space. Calculations are then carried out for the combustion of methane in air with the formation of the following combustion products: carbon dioxide (12%), water vapor (15%), and nitrogen (73%). It is shown that combustion product recirculation lowers the maximum temperature of the jet. It is also shown that the addition of a combustion product to air is much more effective from the standpoint of temperature reduction than the addition of the combustion product to the fuel.

A87-10406 Comparative kinetic calculations of the turbulent combustion of air-hydrogen-methane mixtures (Sravnitel'nye kinticheskie raschety turbulentnogo goreniia vozdushnykh smesei vodoroda i metana). V. IA. BASEVICH, V. P. VOLODIN, S. M. KOGARKO, and N. I. PEREGUDOV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 22, May-June 1986, p. 44-50. 12 refs.

The chemical kinetics of combustion is analyzed numerically for the one-dimensional case. A system of equations is solved for instantaneous parameters, with the turbulent velocity field modeled statistically. The mechanism adopted here includes 35 processes (direct and inverse reactions) involving 18 particles (O2, H2, OH, H, O, HO2, H2O, H2O2, CH4, CH2, H2CO, CO, CO2, N2, NO, and N). Calculations are made of flame propagation velocities and of the reaction zone width.

A85-46245 The mechanism of the electrical conductivity of jet fuels (O mekhanizme elektroprovodimosti reaktivnykh topliv). A. I. BELOUSOV and E. M. BUSHUEVA, (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Neftianoi Promyshlennosti, Moscow, USSR), *Khimiia i Tekhnologiia Topliv i Masel* (ISSN 0023-1169), No. 7, 1985, pp. 35-38. 10 refs.

An analysis of experimental data for the jet fuels RT, TS-1, T-1, and T-6 indicates that the conductivity mechanism of fuels with and without antistatic additives is essentially that of electron conductivity. This mechanism is largely determined by the semiconducting properties of polar compounds contained in the fuels or introduced into the fuels in the form of additives. Depending on the steric factor of the additive molecules and on the presence of structural transformations, electron transmission between molecules can occur through both tunneling and jump mechanisms. The results obtained make it possible to explain the efficiency of antistatic additives in terms of semiconductor theory.

A85-31572 Estimation of structural transformations in jet fuels from electrical conductivity and viscosity (Otsenka strukturnykh prevrashchenii v reaktivnykh toplivakh po elektroprovodimosti i viazkosti). A. I. BELOUSOV and E. M. BUSHUEVA (Vsesoiuznyi Nauchno-Issledovatelskii Institut Meftianoi Promyshlennosti, Moscow, USSR) *Khimiia i Tekhnologiia Topliv i Masel*, (ISSN 0023-1169), No. 3, 1985, pp. 20, 21. 11 refs.

The temperature dependences of the electrical conductivity and viscosity of jet fuels with a crystallization temperature below −60 C (T-1, RT, TS-1, and T-6) have been investigated with the objective of detecting structural transformations. An analysis test results indicates the presence of structural transformations in the jet fuels at temperatures well above the crystallization point. The data obtained can be used for estimating the contribution of structural transformations to an increase in the viscosity of the fuels.