# CONTENTS, ABSTRACTS AND KEYWORDS OF PAPERS

## FATIGUE STRENGTH OF BASALT FIBER- AND GLASS FIBER-REINFORCED PLASTICS AT LONGITUDINAL BENDING AND TENSILE

A.N. Blaznov, V.F. Savin, E.A. Portnov, V.V. Samoilenko, V.V. Firsov

*Glass fiber- and basalt fiber-reinforced plastics were tested for fatigue under cyclic longitudinal bending and tensile. The resultant linear plots of the fatigue life against specific work (logarithmic scale) under tensile and longitudinal bending are located parallel to each other. The ratio of the plotted works under longitudinal bending and tensile was 1.26 for GFRP and 1.20 for BFRP, which is on a par with the literature data obtained from tensile and bending fatigue tests of composites.*

*Keywords: cyclic testing, basalt fiber-reinforced plastic, glass fiber-reinforced plastic, longitudinal bending, tensile, fatigue strength, fatigue life.*

## MOISTURE TRANSFER IN BASALT FIBER-REINFORCED PLASTICS ON THE BASIS OF NANOSILICA-MODIFIED EPOXY-ANHYDROUS BINDER

D.E. Zimin, N.N. Khodakova, T.K. Uglova V.V. Samoilenko, A.N. Blaznov

*The effect of the nanomodification of an epoxy binder on key processes occurring in a composite material when exposed to temperature and moisture factors was studied. The influences of temperature and moisture on main performance characteristics of basalt fiber-reinforced plastic items were evaluated, and the basalt fiber-reinforced plastic resistance to moisture was determined with prediction of moisture transfer rate and maximum moisture content.*

*Keywords: epoxy binder, nanomodification, silica, basalt fiber-reinforced plastic, water absorption kinetics, sorption, desorption, moisture transfer, strength.*

## MODEL DESIGN MONOTONICALLY METAL FLOW IN THE SHAPING PROCESS OF PRECAST PREFORMS

M.I. Poksevatkin, S.V. German, E.M. Basova

*The conditions monotone metal flow during deformation of the assembled preforms and their implementation.*

*Keywords: condition, monotony, flow metal, assembled preforms*

## PROCESS OPTIMIZATION OF BORIDING IN CASTING GREY CAST IRON

T.V. Mustafina, G.A. Mustafin, I.V. Marshirov

*Article is devoted to research of the influence of boriding on deformation characteristics of samples from cast iron. Microstructures of borided cast iron and dependence of the microhardness on boriding depth are given. The boriding technology in casting grey cast iron, required materials and modes are shown. The planning matrix is developed and the optimization options and factors are selected. The regression equation is developed for determining the direction of optimization.*

*Keywords: borating ,deformation, structure, grey cast iron, experiment planning, factor, parameter, thermocouple.*

## EFFECT OF RARE EARTH ELEMENTS CONTAINED IN THE SOLID MINERALS ON THE STRUCTURE OF THE RESULTING CATALYST MATERIALS SHS-FILTERS

S.A. Malashina, T.V. Novoselova, N.N. Gorlova, G.V. Medvedev, A.A. Sitnikov

*The paper deals with the use of solid minerals as raw materials used to produce catalytic materials. In the case of catalytic materials for the synthesis of SHS and eliminates the need for cleaning, e.g., rare earth metal in complex technologies. Given these circumstances, it is possible hypothesis about the possibility of using separate grinding ore, the charge for the preparation of porous permeable catalytic materials for cleaning exhaust gases of internal combustion engines.*

*Keywords: catalytic materials and the exhaust, charge, rare earth metals, ores grinding.*

## STRUCTURE ANALYSIS OF CASTING BORIDED CAST IRON

T.V. Mustafina, G.A. Mustafin

*Structure analysis of borided castings from grey cast iron was made. Boriding was produced in casting of grey cast iron in sand form. Dependence of borided case structure on surface of grey cast iron casting on the temperature and size of casting is established.*

*Keywords: borating, chill, deformation, structure, microhardness, grey cast iron.*

## DEVELOPMENT OF VARIOUS DIE STEEL HEAT RESISTANCE

L.D. Sobachkina, V.B. Butygin

*The ways of alloying elements in the die steels amount is allows to reduce their cost. The obtained steel compared with the standard, such 4H5F1S 3H2V8F and can operate over a wider range of temperatures from 300 to 750 ° C. The investigated steel can be recommended for punches and dies in hot de formation of alloy structural steels and superalloys, mold injection molding of nonferrous alloys.*

*Key words: heat treatment, alloying, heat resistance, stamps, hardness, phase composition, forging, carbides, quenching temperature, grain size.*

## MINIMIZE THE COST OF METAL AT FORMATION PROCESS IN CLOSED BOX PASS TOOL

M.I. Poksevatkin, E.M. Basova, S.V. German

*Summary: Described the design model to minimize the consumption of metal in formirorvanii products in closed calibers.*

*Keywords: model, minimization, metal consumption, product, closed caliber.*

## INCREASING THE OPERATIONAL RELIABILITY OF THE SPRINGS OF RAIL TRANSPORT

G.A. Okolovich, V.I. Levkov, D.V. Kurakov, E.O. Chertovskih, S.V. German, M.V. Gerter

*Improvement in the mechanical properties of siliceous spring steels 55S2A, 60S2A may be increased an additional economical doping chromium and vanadium, as well as the appropriate heat treatment.*

*Keywords: spring steels, brittle fracture, the elastic limit, the residual austenite, hardening, tempering, isothermal hardening.*

## DEVICE FORCAPACITANCE PER UNIT LENGTH MEASURINGOF THE SINGLE-CORE ELECTRIC WIREFOR PROCESS CONTROL

A.E. Goldstein, G.V. Vavilova

*Technical in-process implementation of the electrical method to measure the electrical capacitance per unit length of a single core electric wire is described. The design of the electro-capacitive measuring transducer is suggested. The block diagram of the capacitance per unit length measurer on the basis of the proposed method is created. The front panel ofdevice for the capacitance per unit length measuring is presented and itsoperating principle is described. The effect of changes in water conductivity on measurement results is analyzed. Techniques to offset from the effect of changes in water conductivity on the control resultsare proposed.*

*Keywords: single-core electric wire, capacitance per unit length, electro-capacitive measuring transducer, water conductivity.*

## THE BLURRING MODEL IN THE IMAGE OF THE VIBRATING TEST OBJECT BASED ON STROBOSCOPIC EFFECT

E.A. Zryumov, S.P. Pronin

*In the article the blurring model in the image of the vibrating test object based on the stroboscopic effect, which is used for construction of control methods of vibration parameters when at equality of frequency of vibration and frequency of video camera photodetector is considered.*

*Key words: vibration, image of test object, blurring, stroboscopic effect.*

## DEVELOPMENT AND RESEARCH PROCESS COMBINED FINISHING DEBURRING-TREATMENT AND SURFACE HARDENING OF AT MILLING

E.S. Ognevenko, A.Y. Kryazhev, E.Y. Tatarkin, Y.A. Kryazhev

*The dependences of the roughness parameters of acoustic emission during milling, to monitor the quality of the surface layer to replace the instrument and adjust the cutting conditions in real time. The dependences of the hardness of the surface to be treated on the diameter and length of the cutting elements (wire) milling tool, to monitor the degree of work hardening in real time. Developed a concept of measuring complex for the diagnosis of roughness and hardness of the surface layer in the metal in real time. Using the complex will improve the quality of the treated surface, apply the milling process using wire for reinforcement and finishing machining operations.*

*Keywords: milling, acoustic emission, roughness , cutting conditions.*

## LASER MEASUREMENT SYSTEM FOR MONITORING CONSTRUCTION ELEMENTS ANGULAR POSITION

N.A. Sazonnikova, A.S. Nonin A.S., A.S. Tkachenko, D.N. Voblikov

*To improve the monitoring of provisions of parts during assembly and subsequent operation the laser measuring system is designed to control the angular position of the structure. The small-sized measuring rotary system providing high accuracy (error ≤ 2") when significant working distance between the test object and the autocollimator up to 20 m and a relatively wide measurement range (10...12') is realized. The method of "straight angled serifs" was constructed to solve this problem. As a result of the analysis the measuring error of co-ordinates of centre of the image on an instrument CCD matrix is revealed.*

*Keywords: laser measuring systems, the angular position, structural elements.*

## DETERMINATION OF SOME PARAMETERS OF THE WORKINBODY IN AN OPEN ADIABATIC SYSTEM

A.A. Balashov, B.Y. Golev

*The brief analysis of adiabatic expansion of the working fluid in the open thermodynamic system in order to determine the specific heat of adiabatic process $S_a$, adiabatic index **m** and the ratio of gas-dynamic losses $\xi$, a result of which the expression of these parameters to determine the working fluid in adiabatic flow.*

*Key words: heat capacity, the adiabatic index, an indicator isentrope, open system, thermodynamic process, gas-dynamic losses adiabatic process.*

## CRITICAL FLOW OF GASES THROUGH THE EXHAUST VALVE DURING EXHAUST BLOWDOWN OF 4-STROKE DIESEL ENGINES

A.A. Balashov, M.E. Bryakotin

*The author examines the conditions of critical flow regime of exhaust gases during the release blowdown of a 4-stroke diesel engines. The necessity to take into account the effect of the gas-dynamic losses of critical flow regime is proved in theory and by experiment. It is shown that there is a low probability of occurrence of a critical gas flow through the valve in the gap between the exhaust blowdown.*

*Key words: critical gas flow, supercritical gas flow, exhaust blowdown, exhaust valve, gas-dynamic losses, isentropic exponent, adiabatic exponent, specific work, specific heat, thermal.*

## THE STUDY OF CAVITATION ACTIVITY LIQUID MEDIA BY CONTROLLING THE PARAMETERS OF PIEZOELECTRIC ULTRASONIC OSCILLATORY SYSTEMS

V.N. Khmelev, R.V. Barsukov, E.V. Ilchenco, N.S. Popova, D.V. Genne

*The article presents the results of experimental studies allowed to establish the dependence between the electrical parameters of piezoelectric oscillatory systems and the power of cavitation noise generated when an ultrasonic treatment of liquid process media.*

*Index Words: ultrasonic, electronic generator, load, control, cavitation.*

## STUDY OF THE STRUCTURE OF NITRAMIDE BY IR SPECTROSCOPY AND ITS DECOMPOSITION BY DSC TECHNIQUE AT ELEVATED PRESSURE

D.S. Il'yasov, S.G. Il'yasov, A.L. Vereshchagin

*The nitramide structure obtained from dinitrourea was studied by infrared spectroscopy. The IR spectrum of the sample was shown to differ from that of the nitramide sample synthesized from sodium sulfamate in that the spectrum has associated intermolecular hydrogen bonds. There is one absorption band at 3380 $cm^{-1}$ corresponding to vibrations of the bond of the imine nitrogen proton (H–N=), one absorption band in the region of 1510 $cm^{-1}$ corresponding to vibrations of the double bond at the nitrogen atoms (–N=N–); asymmetric vibrations of the nitro group are shifted downfield at 82 $cm^{-1}$, while symmetric vibrations of the nitro group are shifted upfield at 50 $cm^{-1}$. The nitramide sample was subjected to thermal analysis by DSC technique. Following the findings, the formation enthalpy of nitramide (I) was calculated that is equal to -86.32 ± 0.50 kJ/mol. The sample of nitramide (II) derived by subliming is equal to -76.48 ± 0.50 kJ/mol.*

*Keywords: nitramide, N,N'-dinitrourea, FTIR spectroscopy, DSC, thermal decomposition/*

## SYNTHESIS AND PROPERTIES OF SUBSTITUTION PRODUCTS OF THE NITRO GROUP OF 1-METHYL-5-NITRO-1,2,4-TRIAZOLE BY ETHYLENE GLYCOL

I.A. Krupnova, G.T. Sukhanov, A.G. Sukhanova, Yu.V. Filippova

*It is shown that 1-methyl-5-nitro-1,2,4-triazole enters into a react $S_N^{ipso}$ substitution of the nitro-group by ethylene glycol to form 5,5 '- [1,2-ethane-diilbis (oxy) bis (1-methyl -1H-1,2,4-triazole)] in 63% yield.*

*Keywords: dihydric alcohol, 1-methyl-5-nitro-1,2,4-triazole, ethylene glycol, biological activity.*

## MASS-SPECTROSCOPIC STUDY OF N-METHYL-3-NITRO-1,2,4-TRIAZOLES

I.A. Krupnova, G.T. Sukhanov, Yu.F. Filippova, A.G. Sukhanova, K.K. Bosov

*N-methyl-3-nitro-1,2,4-triazoles are characterized by high stability of the molecular ions under mass-spectroscopic study by electron impact. The fragmentation nature is little dependent on the location of the methyl substituent. The main direction of the fragmentation of N-methylnitrotriazoles is the elimination of the endocyclic substituents ($NO_2$ and $CH_3$) of the nitrotriazole ring followed by its decay into the $CH{=}NH^+$ and $CH_3N_2^+$ ions.*

*Keywords: N-methyl-3-nitro-1,2,4-triazoles, mass spectra, molecular ions, fragmentation, electron impact.*

## FEATURES OF WATER DROPLETS WITH A SOLID INCLUSION EVAPORATION IN HIGH-TEMPERATURE GAS FLOW

M.V. Puskunov, P.A. Strizhak, A.A. Shcherbinina

*The experimental investigations of intensive evaporation at heating an inhomogeneous water droplet with an opaque solid inclusion (graphite particle) in a high-temperature (450÷1000 K) gases medium have been carried out using high-speed video recording facilities. The features of inhomogeneous droplet evaporation from an external (free) border have been determined. Two modes of water droplet with a solid inclusion intensive evaporation have been identified. Their occurrence is probabilistic in the experiments under identical conditions. It has been found, that inhomogeneous droplet intensive evaporation is performed at a gas medium temperature below 800 K, while maintaining liquid film integrity until the completion of the endothermic phase transformation. The conditions of "boiling" droplets "explosive" destruction are realized at gases temperatures over 800 K.*

*Keywords: evaporation, "explosive" destruction, inhomogeneous droplet, solid particle, high-temperature gases.*

## ECOLOGICAL FRAMEWORK UNDERPINNING SUSTAINABLE ENVIRONMENTAL MANAGEMENT IN THE ALTAI REGION

M.Y. Shishin, O.Z. Engoyan

*The article deals with formation of ecological framework as objectively necessary element of sustainable environmental management and ecologically safe development of socio-natural systems. It also proved some relationship between environmental and economic processes being characteristic for the Altai region.*

*Keywords: sustainable development, sustainable use of natural resources, socio-natural systems, ecological framework, protected areas, adaptation to climate change, desertification, systematic approach, environmental safety.*

## PHYSICAL AND CHEMICAL MODIFICATION OF LARCH WOOD WASTE

N.G. Komarova, P.S. Yudin

*The process of modifying dichlorodimethylsilane larch wood. Analyzed the effect of pretreatment (prehydrolysis and explosive autohydrolysis) and silylation conditions on weight gain and associated silicon content.*

*Key words: larch, physico-chemical modification, silylation dichlorodimethylsilane.*

## SOLVENT RATIO EFFECT ON COPPER (II) NANOOXIDE YIELD IN THERMOLYSIS OF N,N'-DINITROUREA COPPER SALT

S.G. Ilʹyasov, M.V. Tilʹzo, I.V. Kazantsev

*A method for the preparation of copper oxide nanopowder was optimized via thermolysis of the copper complex of N,N'-dinitrourea in an aprotic solvent (DMF). The influence of the solvent ratio on the sedimentation time and product yield is shown.*

*Keywords: copper oxide, copper nanooxide, nanopowder, thermolysis, N,N'-dinitrourea, N,N'-dinitrourea copper salt.*

## A STUDY OF THE PROCESS FOR HEXABENZYLHEXAAZAISOWURTZITANE

Yu.A. Kryukov

*The yield of hexabenzylhexaazaisowurtzitane as a function of temperature and reaction mixture acidity was studied. The possibility to decrease the consumption of acetonitrile by means of partially replacing a fresh solvent with recycled process solutions was established.*

*Keywords: hexabenzylhexaazaisowurtzitane, benzylamine, glyoxal, formic acid, acetonitrile.*

## ENHANCING SAFETY OF PRIMARY EXPLOSIVES WITHOUT USING DESENSITIZERS

Yu.V. Perederin, M.V. Kazutin, M.V. Komarova

*Shock and shock-shear sensitivities of lead azide and silver azide samples being in the finely dispersed state were studied herein. A decrease in sensitivity of the samples compared with commercial samples was shown.*

*Keywords: azides, shock sensitivity, safety.*

## COMPARATIVE SYNTHESIS TITANIUM SULFIDES

L.A. Bogdankova, D.M. Chukhleb

*The method of SHS produced sulfides of titanium compounds: $Ti_2S$ having orthorhombic cell, TiS rhombohedral lattice, $TiS_2$ hexagonal system, $Ti_3S_4$ hexagonal system. To determine the ratio of the initial components of the charge, the conditions for obtaining products with a high content of the basic substance. The comparative synthesis of sulfides of titanium classical method of two-temperature sintering methods for synthesis and annealing step, in the form of tablets and powder samples. The phase and quantitative composition of the synthesis products.*

*Keywords: titanium sulfide, SHS (SHS), sintering, two-temperature synthesis, step annealing.*

## ENZYMATIC HYDROLYSIS OF FIBROUS PRODUCT FROM OAT HULLS AT DIFFERENT SUBSTRATE LOADINGS

E.I. Makarova, V.V. Budaeva

*Enzymatic hydrolysis of a new type of a cellulosic substrate—fibrous product specimen from oat hulls—has been studied for the first time at different initial substrate loadings in buffer and aqueous media. As the initial substrate concentration was increased from 60 to 90 g/L, the final concentrations of reducing sugars in the hydrolyzate were found to rise from 53 to 73 g/L in an acetate buffer and from 52 to 71 g/L in an aqueous medium, the yields of reducing sugars diminishing from 80 to 73% in the acetate buffer and from 78 to 71% in the aqueous medium. The outcome of the fibrous product hydrolysis was shown to differ from that of the pulp enzymolysis. When volumetrically scaling up the enzymatic hydrolysis of the fibrous product from oat hulls in order to produce highly concentrated aqueous solutions of reducing sugars, essentially glucose, as nutrient broths for microbiological synthesis, it is advisablethat the initial substrate concentration be 60-75 g/L.*

*Keywords: oat hulls, pretreatment, fibrous product, enzymatic hydrolysis, substrate loading, reducing sugars yield.*

## PROPERTIES AND CHARACTERIZATION OF SORBENTS ON THE BASIS OF SHELL OF PINE NUTS

A.V. Bogaev, M.A. Poletaeva, I.A. Lebedev, E.S. Chernyaeva

*The article presents a comparative description of the properties and characteristics of sorbents derived from shell of pine nut. The influence of different modifiers on the properties and characteristics of the sorbents and their changes at all stages of processing.*

*Keywords: active carbon sorbents, adsorption activity, obtaining of sorbents, the basic properties of sorbents.*

## HARMONIC ANALYZER BASED ON PWM METHOD

A.A. Aravenkov, Y.A. Pasynkov

*Harmonics determination method based on pulse-width modulation is described. Functional scheme is given. Modulation is made. Number of impulses of pulse-width modulation signal per harmonic period, discreteness of pulse-width modulation signal, frequency deviation of harmonic influencing on harmonic determination error are explored.*

*Keywords: pulse-width modulation, harmonic analysis, errors analysis.*

## DEVELOPMENT OF DETECTION SYSTEM BASED ON MICROCOMPUTER BEAGLEBONE FOR SMART LIGHTING SYSTEM

A.S. Goponenko, I.G. Matveev, A.V. Yurchenko, M.K. Kovalev

*In the paper smart lighting system based on microcomputer Beaglebone is considered. The analysis of existing motion and presence sensors was conducted, and then was used as a basis for design of the detection system with optimal sensors. Detection system and the corresponding connection solution for smart lighting system were developed. Using designed smart lighting system, experimental studies were conducted.*

*Keywords: smart lighting system, microcomputer Beaglebone, motion sensor, presence sensor.*

## ERROR ESTIMATES OF DISCRETENESS WHILE MEASURING AN ELECTRICAL POWER OF SINUSOIDAL SIGNALS

M.M. Babichev, Y.A. Pasynkov

*Estimates of the maximum methodical error of discretization in case of measurement of power of sine signals by voltage and current ADCs are given. It allows to select a number of bits of ADC so that the discretization error in a wide range of the measured power didn't exceed the given limits.*

*Keywords: error of discreteness, error boundaries, measuring of power, sinusoidal, ADC, number of bits, phase angle.*

## SELECTION AND JUSTIFICATION OF MATHEMATICAL MODEL THE ENERGY FLOWS IN LOCAL ELECTRIC MNOGUROVNEVYH NETWORKS

N.I. Smolentsev, S.A. Chetoshnikov

*The results of the mathematical models of energy flows in the local microgridusing the wind turbine, photovoltaic system (PV), the diesel generator (DG) and energy storage (ES). Purpose is to determine the optimal parameters of the network and of alternative energy sources, allowing to carry out technical and economic optimization. Work performed under the grant agreement № 14.577.21.0069 from 06.05.2014, the (RFMEFI57714X0069), the customer – the Ministry of Education and Science of the Russian Federation.*

*Keywords: local electric grid, energy storage, alternative energy sources, intelligent control system, high-temperature superconductivity (HTSC).*

## WAYS OF OFFSET FROM THE FACTORS INFLUENCING ON THE RESULTS OF CABLE INSULATION CONTROL CARRIED OUT WITH THE COMPLEX METHOD

N.S. Starikova, V.V. Redko

*In this paper the complex method of cable insulation control is described. This method consists in measurement of changes in cable electric capacitance per meter during the spark testing. The analysis of influencing factors is provided, the ways of offset from these factors are offered.*

*Key words: spark testing, cable, electrode, electrical capacitance, offset.*

## ANALYSIS OF ENERGY EXCHANGE IN RECORDING PROCESS OF THE DYNAMIC VOLUME HOLOGRAM FOR POINT OBJECT

Yu.Ts. Batomunkuev

*It are analyzed the types of the energy exchange in the process of recording of the volume hologram for point object because of an increase of the diffraction efficiency of diffraction orders, of the difference in the intensities of the recording waves, of shift of interference pattern, and of the increase efficiency of the "noise" gratings. It are presented a examples of calculation graphs of the relative intensities of the transmitted waves which show that character of energy exchanges are significantly different for waves with different intensities and for waves because of shift of the interference pattern, and the difference in the intensities of the recording waves in the second diffraction order significantly less than in the first diffraction order.*

*Keywords: hologram, recording hologram, diffraction efficiency.*

## RESEARCH OF EFFICIENCY OF RENEWABLE HEAT EXTRACTION WITH THE VERTICAL GHE

V.Y. Fedyanin, N.B. Sharipov

*Considered system extract low-grade heat of the surface layers of the Earth using a ground heat exchangers of heat pumps and using it for heating buildings. The results of field tests of the heating system of a residential building based on heat pump systems with U-shaped ground heat exchanger.* *This work was supported by RFBR, No. 15-48-04071.*

*Key words: radiation balance, the potential of renewable heat, heat pump heating system, termoguajira, U-shaped ground heat exchanger.*

## ON THE EFFECTIVENESS OF PARALLEL COMPUTATIONS TECHNOLOGIES EVALUATION FOR A NUMBER OF APPLIED MATHEMATICS AND MECHANICS PROBLEMS

G.V. Pyshnograi, Yu.B. Tregubova, N.M. Avetisyan, A.E. Kuznetsov, M.Yu. Tolstyh, A.N. Tsygankov

*The paper considers the effectiveness of using different parallel computation technologies, as well as the possibilities of MATLAB and FLUENT for calculation of problems in computational fluid dynamics and statistical mechanics, and studies the effectiveness of built-in parallelization algorithms on the example of some problems. It shows the efficiency of using CUDA technology in parallel computing on multiprocessor systems for the simulation of incompressible and slightly compressible continuum mechanics with Newton's law.*

*Keywords: mathematical simulation, parallel computations, CUDA.*

## THE USE OF MAGNETIC MEDIUMS FOR A CAPACITIVE SENSITIVE ELEMENT OF THE MAGNETIC FIELD SENSOR

D.O. Zyatkov, A.V. Yurchenko, V.B. Balashov, V.I. Yurchenko

*The article presents the results of an experimental study of the sensitive elements of the capacitive magnetic field sensors with different magnetic fillers. The sensor is based on the change of capacity containing magnetic filler from the magnitude of magnetic field. Influence of an external magnetic field on a capacitive sensitive element with a magnetic fluid filled with different magnetic powders is studied. The change of capacity of plate condenser from the magnitude of magnetic field depending on the processes of chain aggregates structure formation is shown.*

*Keywords: magnetic fluid, magnetic field, capacitive sensitive element, chain aggregates.*

## PHOTONICS OF MESOSCALE ISOLATED DIELECTRIC PARTICLES: A SHAPE FACTOR

I.V. Minin, O.V. Minin, N.A. Kharitoshin

*The problem of extreme radiation focusing in the space area with subwavelength size when using the features of the interaction of radiation with isolated dielectric particles of arbitrary shape and characteristic dimensions equal to the wavelength are described. The results of numerical calculations of the intensity of the electromagnetic field near the surface of such particles are discussed. The problems of local focusing of non-absorbing mesoparticle («photonic mezojet») are also discussed. It was found that the variation of the particle shape and orientation in space relative to the direction of incidence of radiation with fixed parameters of the material allows it to effectively control the amplitude and the spatial characteristics of the "photon mezojet".*

*Keywords: photonics, mesoscale, dielectric particle, photonic jet.*

## VOTING ALGORITHMS IN PROFICIENCY TESTING PROGRAMS OF TESTING LABORATORIES

S.V. Muravyov, I.A. Marinushkina

*When conducting interlaboratory comparisons it is necessary to have a procedure for determination of a reference value on the basis of results provided by comparison participated laboratories. The paper discusses the possibility of using methods based on voting procedures in proficiency testing programs of accredited laboratories: the Nielsen's method corresponding to the "simple majority rule" and proposed by the paper authors preference aggregation approach. It is shown that the preference aggregation method allows to obtain more accurate estimate of the reference value of participating laboratories measurement results.*

*Keywords: proficiency testing programs, interlaboratory comparison, reference value, preference aggregation.*

## THE CREATION OF A MONITORING SYSTEM FOR RESEARCH ON THE EFFECTIVENESS OF ULTRASONIC TREATMENT IN FLOW VOLUMES

S.V. Levin, V.N. Khmelev, S.S. Khmelev, Y.M. Kuzovnikov, S.N. Tsyganok

*The article discusses the research and creation of a monitoring system for research on the effectiveness of ultrasonic treatment in flow volumes based on the measurement of vibration amplitude and its distribution along the surface of the technological volumes.*

*Key words: ultrasonic technological devices, ultrasonic treatment.*

# GRAPHICAL METHOD FOR CORRECTION OF HIGHER ORDER ABERRATIONS OF HOLOGRAPHIC OPTICAL ELEMENT

Y. Batomunkuev, A. Dianova

*It is presented a graphical method for solving of nonlinear systems equations of higher order aberration correction for thin and volume holographic optical elements (HOE). This method allows to select such changes of HOE's parameters that aberrations will be not more by specific limit. It is considered as an example correction of the first spherical aberrations of the fifth, seventh and ninth-order for reflecting volume holographic optical element. It is shown that the choice of HOE's parameters allows to correct all of higher order aberrations.*

*Keywords: holographic optical element, higher order aberration.*