

# Summaries

**Yu.P. Pokholkov, V.A. Vlasov**  
**THE SCIENTIFIC POTENTIAL OF TOMSK POLYTECHNIC UNIVERSITY**

The article is dealt with the analysis of the up-to-date state of research and scientific activities of the University. TPU, among a few Russian universities, has gained recognition of the status of a scientific organization of the Russian Ministry of Industry and Science according to the research findings. As a result, it was awarded state accreditation. The success has been conditioned by the following: leading scientific and educational teams and the developed infrastructure for carrying out R&D, including three research institutes, cybernetic centres and labs that allocate the unique equipment for research in nuclear and accelerating engineering, high voltage electrophysics, physics of dielectrics, physics of plasma, geology and oil-gas industry, chemical engineering, etc. In 2001, 30% of R&D fell to the share of TPU realized by the universities of the West Siberian region under economic contracts and agreements. Replenishment of postgraduate and doctoral courses with the youth, student intensive participation in research gives grounds to optimistically look to the future research accomplishments of TPU.

UDC 539.172.17

**M. Kroening, H. Baumbach, I.P. Chernov, Yu.I. Tuyrin**  
**NON-EQUILIBRIUM METAL-HYDROGEN SYSTEMS**

The non-equilibrium metal-hydrogen systems have been surveyed in the article. Electron irradiation of metals saturated by isotopes of hydrogen in the pre-threshold area, atomic hydrogen isotope and ion migration has been studied. Processes of hydrogen isotope exchange during metal contacts have been investigated. Mechanisms of radiation-induced atomic hydrogen isotope exchange and hydrogen isotope release from metals associated with the accumulative properties of the internal hydrogen atmosphere have been discussed.

UDC 533.9

**I.A. Tikhomirov, V.A. Vlasov, Yu.Yu. Lutzenko, A.A. Zorin**  
**ELECTRODYNAMICS OF HIGH-FREQUENCY FLARE DISCHARGE**

The analysis has been conducted in relation to electrodynamics of high-frequency flare discharge. Suggested and proved was the electrodynamic model of high-frequency flare discharge.

UDC 669.017:539.373

**V.E. Panin, A.I. Slosman, N.A. Antipina**  
**MEZO-MECHANICS OF SURFACE STRENGTHENED MATERIALS**

Surface strengthening of materials has always been and is still being one of the most relevant problems of material science. Surface strengthened materials have not a uniform structure and their behaviour is not possible to completely and adequately analyze under the load neither on the basis of strained rigid bodies nor dislocation theory. More than score years ago Tomsk School of Material Science has developed a new scientific line in the field of physics of plasticity and strength which is successfully developing now – physical mezo-mechanics of heterogeneous materials. The Department of Composites and Coatings, TPU during a number of years has been carrying a re-

search into the behaviour of surface strengthened materials under the load, including those under wear based on the conceptions of physical mezo-mechanics. The results of these investigations will be useful for optimization of modes of surface strengthening of materials depending on the requirements for their properties and forecasting the behaviour of these articles while running.

UDC 541.135.7:541.138.2

**V.V. Korobohkin, E.A. Khanova**  
**NICKEL AND CADMIUM DESTRUCTION AT THE ALTERNATING CURRENT ELECTROLYSIS IN THE ALKALINE SOLUTION**

The influence of different parameters on the speed of metallic nickel and cadmium electrolysis in the alkaline solution at the alternating current of industrial frequency was studied. It was shown that the speed of the process increased with the increasing of the alkaline concentration and depended on the alternating current density and temperature. The product phase composition and its change at the heat treatment were studied by XRD and thermal analysis methods.

UDC 556.3 (571.1)

**A.D. Nazarov**  
**REGIONAL HYDROGEOLOGICAL STRATIFICATION SCHEME FOR THE SOUTH-EAST PART OF THE WEST-SIBERIAN OIL-GAS PETROLIFEROUS PROVINCE**

A scheme of hydro-geological stratification of water-host artesian reservoirs on the example of the South-East part of the West-Siberian oil-gas province is proposed in the article. This scheme includes hydro-geological etages, jaruses, kompleksus, horizons, plasts and soils, which suit sedimentary giga-, mega-, macro-, meso-, milli- and microcyklalithos.

UDC 535.37:548.736 + 550.8

**M.V. Korovkin, O.A. Ivanova, E.F. Polisdova, V.I. Korepanov**  
**LUMINESCENT PROPERTIES OF NATURAL TOPAZ CRYSTALS**

The article presents experimental investigations in thermoluminescence, X-ray luminescence, pulse cathode luminescence of a two-color topaz crystal of jewellery quality obtained from pegmatite (Volyn, Ukraine). The article focuses on the luminescence properties of topazes that reflect genetic peculiarities of mineral formation and can be used as typomorphic ones. It has been revealed that pulse cathode luminescence in the range of 280-290 nm is a result of radiative decay of singlet and triplet excitons in a crystal topaz matrix.

UDC 620.179.16:620.165.29

**I.O. Bolotina, G.S. Yevtushenko, A.I. Soldatov, S.A. Tzekhanovsky**  
**ACOUSTIC EMISSION SIGNAL SOURCE AREA DETERMINATION BY THE PHASED ARRAY**

The article describes a technique of phased array converter signals processing and the device based on this technique to coordinate acoustic emission signal sources. Acoustic emission signals are received by converters comprising of two orthogonally-oriented linear phased arrays. The output information is formed by multiplying two signals

each of them is the sum of every array converter signals products. The acoustic emission source location is determined according to the visual two-dimensional acoustic field image of the control area.

UDC 681.5

**O.S. Vadutov, S.A. Gaivoronsky**  
**BOUNDARY DETERMINATION OF ZERO AND POLE LOCATIONS FOR THE INTERVAL PARAMETERS SYSTEM**

The article is dealt with the polyvalent interval analog of the of the root-locus method to investigate dynamic properties of the systems with several interval parameters linearly included into coefficients of transfer functions. Such method allows obtaining the main properties of a parametrical polytope counter image on the complex plane. The boundary determination of the multi-parametrical interval root-locus is based on these properties. A numerical example has been discussed in the article.

UDC 004.38

**V.E. Dreizin**  
**PROSPECTIVE USE OF GEO-INFORMATION TECHNOLOGIES IN NATIONAL ECONOMIC MANAGEMENT**

The article outlines the insufficient intellectuality of the existing tools used for geo-information technologies and the analysis and support of decision-making process in geo-information systems used to control distributed objects and areas. Typification of tasks solved by the similar systems has been carried out, and possible methods of their solution have been described.

**A.G. Kozlov**  
**TOMSK POLYTECHNICS EXPLORE RUSSIAN SPACE**

The article discusses stages of formation and development of the advanced space industry enterprises of Russia. A leading part of the TPU alumni in the development of new spacecrafts and systems is shown.

**A.I. Chernyshov**  
**THE TPU ALUMNI IN THE RESEARCH AND PRODUCTION CENTRE «POLUS»**

The article describes the history of establishment, formation and development of the Research and Production Centre «Polus». The author, the Director General of the Centre, capitalizes on the TPU alumni who played an important part in the establishment of this Centre, one of the advanced enterprises of Tomsk-city.

**V.P. Ivanov**  
**THE ROLE AND OBJECTIVES OF THE RUSSIAN CHEMICAL COMMUNITY IN SOLVING THE PROBLEMS OF CHEMICAL INDUSTRY AND SCIENCE**

The article is dealt with the goals and objectives of the Russian Chemical Community. It reflects the main problems of the Russian chemical complex. Much attention is paid to the state of domestic research and suggestions on antirecessionary steps undertaken through integration and unifying it in a research engineering centre for survived and prospective research institutes.

UDC 66:621.3.035.82

**L.V. Zabelin**  
**AIR CLEANSING IN CELLULOSE NITRATE PRODUCTION**

The article discusses acid decontamination techniques ( $\text{HNO}_3$  и  $\text{H}_2\text{SO}_4$ ) developed on the basis of physical and chemical processes which occur in an eddy flow. These ways have been applied in gun powder industry in producing NC.

UDC 621.311.25:621.039 (571.16)

**V.N. Myesheryakov**  
**THE FUTURE OF NUCLEAR POWER IN SIBERIA AND TOMSK REGION**

The article presents ecological, economic and social prerequisites for construction of the atomic power-plant in the city of Seversk. The

article proceeds on the facts of the development atomic energy in Siberia and Tomsk region.

UDC 621.039.59

**V.M. Korotkevich, V.V. Lazarchuk**  
**THE IMPLEMENTATION OF THE PROGRAM «HIGH-ENRICHMENT URANIUM – LOW-ENRICHMENT URANIUM» AT THE SIBERIAN CHEMICAL COMBINE**

The article is dealt with a transformation flowsheet for highly enriched uranium obtained from metals to its hexafluoride and thinning it with a low content of uranium-235 isotope.

UDC 621.396

**I.I. Vintizenko, A.G. Zherlitzyn, A.I. Ryabchikov, Yu.G. Yushkov**  
**THE DEVELOPMENT OF RELATIVISTIC MICROWAVE GENERATORS IN THE RESEARCH INSTITUTE OF NUCLEAR PHYSICS AT TPU**

The paper presents research findings obtained by the Research Institute of Nuclear Physics in the field of relativistic electronics of microwave devices. Specifications and possibilities of the vircator and relativistic magnetron S-band have been discussed. Experimental data of resonant pulse compression of output relativistic magnetron SHF pulses are presented.

UDC 621.396

**A.G. Zherlitzyn, G.V. Melnikov**  
**RESEARCH INTO THE SHF EFFECTIVENESS IN A VIRTUAL CATHODE-TYPE VIRCATOR**

The article presents the results of investigation of microwave irradiation efficiency in the vircator with a virtual cathode. Discussed are the processes of electron grouping, back-coupling in the triode that influence the generation efficiency.

UDC 620.179.13

**V.P. Vavilov, V.G. Torgunakov, V.V. Shiryayev, A.I. Ivanov, D.A. Nesteruk**  
**HEAT NON-DESTRUCTIVE TESTING PROVIDED IN TOMSK RESEARCH INSTITUTE OF NON-DESTRUCTIVE TESTING**

The field of activity performed by the Research Institute of Non-Destructive Testing focuses on heat control which has been started back to the 70s of the past century and is oriented towards non-destructive testing and checking articles and materials, and also special applications. The equipment for heat control is comprised of infrared temperature measuring systems, especially infrared imagers. At present, investigations cover theoretical solutions of direct and inverse problems of heat transfer, projecting and small-lot production of infrared scanning systems, the development of new ways of heat control and non-stationary information processing algorithms, and also checking of industrial, power and construction projects.

UDC 620.179.155

**Yu.A. Volchenko**  
**NEUTRON DEVICES AND SENSORS FOR EXPRESS NON-DESTRUCTIVE TESTING OF MATERIALS, GOODS AND TECHNOLOGICAL PROCESS PARAMETERS**

The article describes neutron devices and sensors developed in the Department of Radiation Methods of Control (The Research Institute of Non-Destructive Testing, Tomsk, Russia) to carry out the express non-destructive testing of materials, goods and technological process parameters. Major performance attributes and photographs of neutron devices and sensors are presented in the article.

UDC 620.179.15

**B.I. Kapranov, I.A. Korotkova, V.L. Chakhlov, V.N. Filinov, V.J. Maklashevsky**  
**THE ANALYSIS OF SCAN SYSTEMS IN COMPTON TOMOGRAPHY. POSSIBLE FIELDS OF APPLICATION**

The review of the most known circuits and devices of scanning Compton topographies is presented in the article and also their prin-

cycle of operation is analyzed. The scope of installations is described and the list of controllable objects is specified. "TomScan-200" and CBS LBD aperture functions of disseminating volume of the scanning system are described in the article for one of the last developments of tomographs. Their application has been proved from the point of view of the system spatial sanction improvement.

UDC 621.374

**V.V. Lopatin, I.I. Skvirskaya**  
**ELECTRIC DISCHARGE AND ITS TECHNOLOGICAL APPLICATIONS**

The article presents a review of the electric discharge investigations and the new equipment developed in the High-Voltage Research Institute during the last years. Basic ideas on modeling discharge processes in dielectric mediums are also discussed. Described are the new scopes of application of various forms of the electrical discharge.

UDC 541.16

**A.P. Ilyin**  
**THE BLASTING NANO POWDER TECHNOLOGY DEVELOPED IN THE RESEARCH INSTITUTE OF HIGH VOLTAGES AT TOMSK POLYTECHNIC UNIVERSITY**

The article is dealt with the results of investigations fulfilled in the High Voltage Research Institute at Tomsk Polytechnic University which are connected with the wire electrical explosion (WEE) and nano-powder production. Mechanism of the interaction between energy and high density of power and metals has been analysed. The article describes the main achievements of the electrical explosion technology in producing nano-powders of chemical combinations and composites. A new model of an electrical explosive particle, which explained some of unordinary properties of nano-powders (a threshold phenomenon, a high stability of nan-powders at low temperature, supplying energy, etc) was analysed.

UDC 621.311.1.001.5

**A.S. Zavorin, Yu.A. Zagromov, L.A. Belyaev**  
**THE DEVELOPMENT OF ENERGY EFFECTIVE TECHNOLOGIES IN A POWER SYSTEM**

The peculiar feature of basic scientific schools of the Thermal Power Engineering Faculty which were developed in the 80s, are organically connected with problems of engineering practice. The article gives information about the development stages in the area of thermal physics and thermal weight exchange, research conducted into heat power equipment modes and burning Siberian coals.

UDC 621.311

**B.V. Lukutin, R.A. Vainstein, Yu.V. Khrushev**  
**RISING THE LIABILITY AND QUALITY OF CONSUMER POWER SUPPLY**

The article presents new scientific findings provided by the Electrical Power Engineering Faculty at the Electrical Engineering Institute. These findings meet the modern requirements of power industry and are based on traditional schools of Tomsk Polytechnic University. The requirements for power industry objects, a tendency of their development and improvement determine the scientific trends pursued by the departments of the Faculty. The solution of foremost problems is facilitated by long-standing traditions of the Electrical Engineering School of Tomsk Polytechnic University developed by Professor A.A. Potebnya a hundred years ago and was developed in transactions of several generations of electrical engineers. In the article, the review of the most essential modern scientific developments provided by the Faculty is presented, which determines the main research directions of such Departments as Power Stations, Electrical Power Systems and Electrical Power Supply for Industrial Enterprises.

UDC 06.35.51

**S.A. Kosyakov, V.V. Litvak, V.A. Silich, M.P. Silich, M.I. Yavorsky**  
**THE DEVELOPMENT OF THE CONCEPT OF RECONSTRUCTING RESOURCE SUPPLY FOR THE POPULATION BASED ON THE SYSTEMS TECHNOLOGY**

The article is dealt with the development of the concept of re-

source supply for the population on the basis of the systems engineering technology which includes building of declarative model of system, complex analysis of the system and its component, interconnected set of goals and a decision-making process in relation to each of major reconstruction tendencies.

UDC 621.313.333

**O.P. Muravlev, O.O. Muravleva**  
**ACCURACY THEORY AND ITS USE IN ALTERNATIVE TECHNOLOGY IN PROJECTING AND MANUFACTURING ELECTRIC MACHINES**

The article touches the problems of energy saving in all spheres of national economy which becomes necessary for survival of Russia under conditions of its integration into the world economy. The article is dealt with the electrical machines accuracy theory and its application in design and manufacturing. The quality assurance in electrical machines is a complex problem. Electrical, magnetic, thermal, mechanical parameters which differ from a physical nature should be taken into account. The proposed mathematical model allows assessing any parameter in quality shaping of electrical machines. Static handling of research findings related to electrical machines production confirms the model adequacy. A sufficient alternative technology will be possible in projecting induction motors through parameters' spread decrease taking into account a rapid rise in material prices.

UDC 330.34:347.77

**G.A. Barysheva**  
**TRANSFORMATION OF INTELLECTUAL RESOURCES TO THE MARKET TURNOVER**

The article investigates the market turnover of scientific products presented in a form of objects of the intellectual property and venture capital, which has not yet passed the embodiment stage. Discussed are the conditions of transformation of intellectual resources to a manufacturing factors and capital allowed to expand the concept of intellectual property as an independent area of economic relations, methods of establishment and functioning of intellectual property as well as factors which influence the use of intellectual resources in integrated corporations and in small entrepreneurial companies.

BBK 87.4

**A.A. Kornienko**  
**SCIENCE, PHILOSOPHY AND THE PRESENT**

The article discusses the problem of crisis in the contemporary civilization caused by a dehumanizing role of technological progress. Possible ways of formation of a new humanistic world attitude and humanism-oriented science are considered.

UDC 62:655(09)

**V.N. Byelomestnykh, T.A. Romanova**  
**THE HISTORY OF PUBLISHING "BULLETING OF THE TOMSK POLYTECHNIC UNIVERSITY"**

This article is devoted to the 100<sup>th</sup> Anniversary of publishing the first issue of «The Proceedings of Tomsk Emperor Nikolai II Institute of Technology». These Proceedings have been followed by «Buletting of The Tomsk Polytechnic University». The article looks back to the history of publishing this periodical and focuses on the analysis of its initial historical stage.

**A.G. Stromberg**  
**THE HISTORY OF FORMATION, ORGANIZATION AND ACTIVITY OF THE BASIC RESEARCH LABORATORY OF IMPURITIES. 1962-1985**

The history of formation, organization and activity of the Research Laboratory of analysis of semiconductor impurities and high pure substances has been discussed in this article. The years of 1962-1985 related to the activity of the Basic Research Laboratory allocated at that time at the Department of Physical and Colloidal Chemistry is presented. The organization of the Basic Research Laboratory is given and scientific groups which were working during those years are characterized.