

## Summary

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### **EFFECT OF EXPLOSIVE PRESSING ON THE STRUCTURE AND PROPERTIES POLYARYLATES**

The results of studies of thermomechanical properties and structural changes polyarylates DV and F-1 during explosive compaction of powders. It is shown that the explosive processing of polymers 0.67 GPa pressure creates the most favorable conditions for the process of crystallization, increased heat resistance of polymers at 30–35 °C and reduced deformability when heated.

*Keywords:* polyarylate, explosive pressing, sintering, thermomechanical analysis, X-ray analysis, thermomechanical properties, glass transition temperature, heat, deformation, crystallization, degree of crystallinity, the average interlayer distance

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### **FUNCTIONALIZATION OF SURFACE NANOLAYER OF POLYACRYLONITRILE FIBRE**

In this article the study of influence of functionalization on conversion in surface nanolayer of polyacrylonitrile fibre after Radziszewski reaction. Influence of conditions of functionalization on change of nature of surface polyacrylonitrile fibrous material was researched.

*Keywords:* nano-object, Radziszewski reaction, functionalization of surface nanolayer

**G. N. Bepalova, A. N. Larin,  
T. A. Ageeva, A. O. Lebedenko,  
A. K. Morochina**

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### **CARBON FULLERENES AND NANOTUBES — MODIFIERS WATER-THINNABLE COMPOSITIONS FOR ELECTRODEPOSITION**

The possibility of modification of water-thinnable composition on the base KCh-0125 by fullerenes and carbon nanotubes, applied by electrodeposition method, was investigated. Rheological and electrochemical parameters of

the obtained compositions are investigated. Technological modes of drawing them on metal surfaces by an electroplating method are optimized. It is shown that the resulting coatings have high wear resistance.

*Keywords:* Fullerenes, Carbon nanotubes, Varnish-and-paint coatings, Electroplating, Modification, Wear-resistance

**M. I. Biryukova, G. Yu. Yurkov**

A. A. Baikov Institute of Metallurgy and Materials Science of the Russian Academy of Science,

### **APPLICATION OF A METAL-POLYMER NANOCOMPOSITE IN PRODUCTION OF COMPLEX POLYPROPYLENE FIBERS**

A composite consisting of iron-containing nanoparticles 5 nm in size embedded in the low density polyethylene matrix has been synthesized, and polypropylene-based fibers with addition of the nanocomposite have been produced. The nanocomposite and fibers were studied using transmission electron microscopy and x-ray diffraction. Also, biocidal properties of the fibers have been investigated.

*Keywords:* nanocomposite, polypropylene, iron oxides, biocidal properties

**Y. A. Bukina, E. A. Sergeeva**

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### **CREATING A NANOMODIFIED TEXTILE MATERIALS WITH BACTERICIDAL PROPERTIES**

Silver has antibacterial and antiseptic properties and is highly effective disinfectant against pathogens. With plasma modification may receive antimicrobial textile materials with uniformly distributed and sustainable consolidation of silver nanoparticles in the surface layer of the material.

*Keywords:* Modification, plasma, textile material, surface, antibacterial properties, silver nanoparticle

**A. Burinskaia, E. Izmerova, M. Basok,  
G. Checreneva**

St-Petersburg State University of Technology and Design

### **RECEIVING OF NANOPARTICLES OF SILVER ON CELLULOSE MATERIAL**

To antibacterial properties of cellulose fiber recovery method by using in a solution of silver ions glucose, ethylene glycol, glycerol, and UV-radiation. By using of scanning elec-

## ■ summary

tron microscopy method was revealed that the most efficient recovery of silver ions observed in the presence of glycerol with the intensification of UV radiation. Samples with silver nanoparticles show bactericidal activity.

*Keywords:* nanosilver, bactericidal action, destruction, organic substances, UV radiation, electronic microscopy

**S. V. Burinskii, V. A. Lysenko,  
P. Yu. Salnikova**

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### **ELECTRICALLY CONDUCTIVE CARBON FIBER PAPER**

Process conditions effect of papers obtaining from various carbon fiber types on the uniformity of surface density, thickness, conductivity is studied. It is shown the produced papers meet requirements to precursors for gas diffusion layers of fuel cells with polymer proton-exchange membranes.

*Keywords:* carbon fiber paper, polyacrylonitrile fiber, rayon fiber

**V. N. Vasylenko, N. P. Suprun,  
A. V. Schuckaya**

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### **TESTING MECHANICAL PROPERTIES ADHESIVE ENVELOPE OF TEXTILE MATERIALS**

In the this paper was to studied the mechanical properties of two-and three-layered packages of materials for footwear under uniaxial stretching. For the upper layer packages was used volumetric knitted fabric, as the middlelayer — nonwoven material, as the a lower layer was used knitted fabric with the glutinous thread and after antimicrobial finishing. It was showing, that the introduction of the middlelayer in the packages of the, but considerably improves the formation and dimensional stability.

*Keywords:* packages textile materials, antimicrobial properties, stability, comfort.

**M. P. Vasiliev, M. J. Antonova,  
E. P. Shirshova**

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### **RESEARCH OF INFLUENCE OF CONDITIONS OF HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF THREADS ARSELON**

This article analyzes the theoretical structuring aspects of chemical fiber, for example arselon. The results show that the heat-resistant fiber arselon liable to self-hardening by heat treatment in a free state. Improvement of mechanical properties is due to reach a longitudinally oriented, more equilibrium and less heterogeneous structure.

*Keywords:* arselon, heat treatment, orientation, mechanical properties, breaking load, rupture strain, shrinkage

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### **DETERMINATION OF ANTIBACTERIAL PROPERTIES OF TEXTILE MATERIALS, PAINTED WITH NATURAL DYES**

The article deals with the determination of the antibacterial properties of textile materials. An assessment of the antimicrobial activity of knitted fabrics, dyed with plant extracts, which have a bactericidal effect.

*Keywords:* textiles, antibacterial properties and natural dyes

**A. Yu. Golubikhin, A. I. Susanin,  
E. S. Sashina**

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### **PHASE DIAGRAMS OF THE SYSTEMS FIBROIN — IONIC LIQUIDS — PRECIPITANT**

The phase state of the systems fibroin — solvent — precipitant was studied by refractometry and light scattering methods. The solvents used 1-butyl-3-methylimidazolium chloride and acetate, as precipitants water, dimethyl sulfide, dimethylformamide. Given phase diagrams of the studied systems

*Keywords:* silk fibroin, ionic liquids, precipitant

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### **SORPTION EXTRACTION OF NOBEL METALS BY ACTIVATED CARBON FIBROUS MATERIAL**

Activated carbon material Busofit 1 0-D-55 was tested to extract chloride complexes of platinum (II), palladium (II), rhodium (III), ruthenium (IV) and iridium (IV). There was determinate the major factor, influencing the degree of extraction, was calculate degree of sorption, investigated the kinetics of the process.

Together with the platinum metals completely extracted gold, silver, osmium. Under maximum extraction of platinum metals recovery of most ferrous and non-ferrous metals shall not exceed 5–15% and possibility of extraction platinum metals from solutions of complex composition.

*Keywords:* active fibrous carbon material, platinum metals, absorption, busofit, sorption extraction.

**Diankova T. U., Lebedeya G. G.,  
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Stepanova A. B.**

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**THE INFLUENCE OF AGGRESSIVE ENVIRONMENT AND TEMPERATURE ON THE MECHANICAL PROPERTIES OF PARA-ARAMID FIBRES**

This article presents comparative evaluation of mechanical and thermal properties of Para-Aramid fibres Technora and Twaron after exposure to aggressive atmosphere of 10% solutions of H<sub>2</sub>SO<sub>4</sub> и NaOH. Also explored the question of influence of aggressive environment on the mechanical properties of thermoaged Para-Aramid fibres

*Keywords:* Para-Aramid fibres, breaking load, elongation, aggressive atmosphere, influence temperature

**I. P. Ershov, L. A. Zenitova,  
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**DEVELOPMENT POLYMER COMPOSITE FIBERGLASS PLAZMOBRABOTANNYM FILLED FOR MEDICAL INSTRUMENTS NEW GENERATION**

The requirements applicable to the materials used for the production of medical instruments. Proposed as a reinforcing filler composite materials use fiberglass. The effect of plasma modification of glass on its hydrophilic properties.

*Keywords:* fiberglass, plasma treatment, composite, medical instrument.

**N. N. Zhdanov, R. M. Garipov**

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**HIGH-PERFORMANCE INSULATION WITH USE OF NANODIMENSIONAL COMPONENTS**

As the way of power-saving in this article is offered using of new high-performance heat-proofing composite materials, which include hollow spheric stuffs and nano-sized cohesive materials — sols of metal oxides, particularly sols of silica and alumina. This allowed to considerably raise heat-resistance of surface and significantly increase the adhesion to different surfaces or the cohesive strength of the coating.

*Keywords:* thermal insulation, glass microspheres, nanosized oxides of silicon and aluminum, contact conductivity.

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**APPLICATION OF KNITTED CLOTH MANUFACTURED FROM PLASMA ACTIVATED ARAMID FIBERS FOR CREATION LIGHT ARAMID PLASTIC**

In article features of knitted cloths as a reinforcing filler of composite materials, and also the using of composites based on aramid jersey were considered. The effect of plasma modification of aramid fibers on the hydrophilic properties of the fiber and strength of its connection with a matrix of epoxy resin was studied.

*Keywords:* jersey, aramid fiber, plasma treatment, the composite

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**DEVELOPMENT OF THE COMPOSITION AND THE PROPERTIES OF COMPOSITE MATERIALS BASED ON POLYETHYLENE**

We developed formulations of polymer composites based on polyethylene, filled with waste products. Study of the properties of the developed materials showed the feasibility of using waste phenoplasts and basalt wool for filling polyethylene, which can improve the properties of polyethylene, to reduce the cost of the finished product and reduce environmental stress.

*Keywords:* Polyethylene, phenolic plastic, fiberglass, basalt wool, filling, physico-chemical and mechanical properties

**A. N. Krasnovskii, I. A. Kazakov**

Moscow state technological university «STANKIN»

**DEFINITION OF PULLING FORCE FOR AXISYMMETRIC COMPOSITE RODS IN PULTRUSION**

The article presents the description of mathematic model for definition of pulling force for axisymmetric composite rods in pultrusion process. Model takes into account the heating temperature of the die, the degree of polymerization of the product, the resin viscosity, chemical shrinkage, resin pressure and allows calculate the length and position of the dry friction area, It is a distinctive feature of the model. As an example we solved the problem of definition of pulling force for oversized axisymmetric composite rod with different pulling speeds.

*Keywords:* pulling force, composite material, pultrusion, stress-strain state, permeability.

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L. A. Maiorova-Valkova, T. A. Ageeva,  
O. I. Koifman**

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### **TWO-DIMENSIONAL NANOAGGREGATES IN ZINC TETRAPHENYLPORPHIN LANGMUIR LAYERS**

In an experimental and theoretical study of zinc tetraphenylporphyrin (ZnTTP) nanostructured floating molecular layers the regions of existence and characteristics of the monolayer structure and properties in stable states were determined. A quantitative model of ZnTTP floating monolayer with condensed face-on nanoaggregates was created, making it possible to determine how the area per molecule in an M-aggregate, the aggregation number, the diameter of nanoaggregate, etc. depend on the initial surface coverage.

*Keywords:* two-dimensional nanoaggregates, Langmuir layer, M-monolayer model, compression isotherms, metalloporphyrins

**K. I. Olkhovskii, V. P. Panov**

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### **AVAILABILITY OF ANTHROPOGENIC WASTES IN COMPOSITE PRODUCTION**

Availability of anthropogenic wastes in composite materials production was considered. Heavy metals content in solid domestic waste disposal plant composts, as well as bottom sediments have been determined. Quantitative content of organic matter basic types has been determined. Method of heavy metals extraction from anthropogenic wastes has been studied.

*Keywords:* composite material, solid domestic waste composts, bottom sediments, heavy metals

**V. P. Panov**

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### **ENVIRONMENTAL PROBLEMS OF NANOMATERIALS AND NANOCOMPOSITES PRODUCTION**

Environmental safety aspects of nanoparticles, nanomaterials, as their production, environmental and anthropogenic effects have been considered. As also nanoparticles penetration and influence methods upon living organisms have been studied.

*Keywords:* nanotechnology, nanomaterials, nanoparticles, ecological risks, humans healthy

**Y. O. Perminov, V. A. Lysenko,  
O. V. Astashkina, A. A. Lysenko**

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### **FIRE RESISTANT POLYMER MATERIALS. REVIEW**

The review of the key indicators of the flame retardant properties of polymeric materials and composites on their basis: oxygen index, flame propagation, smoke generation, the ability to form char layer etc. Singled out several groups of methods to improve the flame retardant properties of polymers and composites. Discusses the mechanisms of action of flame retardants and intumescent properties of additives.

*Keywords:* fire resistance, fire retardant materials, flame retardants, limited oxygen index, intumescent materials, char layer

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### **НОВЫЕ ПЕРСПЕКТИВЫ В ДИЗАЙНЕ МЕДИЦИНСКИХ ФОТОТЕРАПЕВТИЧЕСКИХ ПРИБОРОВ С ИСПОЛЬЗОВАНИЕМ ОПТОВОЛОКОННЫХ ТКАНЕЙ**

Свет применяется во многих областях, например для отверждения чернил или для терапии желтухи у новорождённых. Каждая область применения требует строго определённой интенсивности излучения и диапазона длин волн. Классическими источниками светового излучения являются флуоресцентные лампы дневного света, ртутные ультрафиолетовые лампы и светоизлучающие диоды, которые обладают очень низким энергопотреблением. К недостаткам этих источников света относятся жесткость конструкции и высокое тепловое излучение.

Использование полимерных оптических волокон с продольным излучением, подключённых к светодиоду, позволяет создать гибкий, очень тонкий и сверхлёгкий источник света, а удалённый источник излучения и электрические элементы, к которым подключены оптические кабели, образуют электро- и теплоизолированную светоизлучающую поверхность.

Эффективность приборов, применяемых для фототерапии новорождённых, зависит от диапазона излучения, интенсивности излучения и от площади освещённой поверхности. Более того, облучение всей поверхности тела должно быть равномерным.

Нами была продемонстрирована эффективность для фототерапии желтухи новорождённых приборов нового дизайна, базирующихся на использовании оптоволоконных тканей. Эффективность оценивалась с помощью стандартного метода *in vitro*.

*Ключевые слова:* фототерапия, ультрафиолет, оптические волокна

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**A NEW APPROACH TO THE  
MODIFICATION OF POLYPROPYLENE  
FIBER MATERIAL DURING THE  
PRODUCTION**

Article focuses on the modifying effects of small amounts of ultrafine polytetrafluoroethylene when immobilized in fibrous materials based on polypropylene with a melt spinning. We analyzed changes in the structure and basic physical and mechanical properties of polypropylene yarn. We examined the effect of ultrafine polytetrafluoroethylene on the morphology and properties of the surface of the filaments.

*Keywords:* polypropylene, filling, fiber, polytetrafluoroethylene

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**INVESTIGATION OF THE PHYSICAL-  
CHEMICAL PROPERTIES OF MAGNETITE  
NANOPARTICLES ON THE POLYAMIDE  
FIBER MATERIALS**

The paper presents the investigation data of magnetic nanoparticles synthesized by different technologies in the presence of polyamide fiber materials. The phase composition of compounds magnetite studied the characteristics of crystal state of iron cations in the structure of these compounds and investigated the magnetic properties of magnetite nanoparticles.

*Keywords:* magnetite nanoparticles, mechanism of geteroagulation, polyamide fiber, process of dying

**O. V. Romankevich, O. A. Garanina,  
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**THERMODYNAMICS OF WETTING**

Description of the surface by the analysis wetting with the use of Guggenheim approach was carrying out in this article. Characteristic of relative change of free energy of interfacial layer in wetting expressed through the new value  $\Delta G_{rel}$  is making possible an estimated change of thermodynamics properties of surface.

*Keywords:* wetting, interfacial layer, surface tension, contact angle, Guggenheim

**N. V. Rusova, O. V. Astashkina,  
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**PROPERTIES OF CARBON SORBENTS  
FOR THE THIN PURIFICATION OF WATER**

In work presented the results of the sorption of heavy metal ions (Cu<sup>2+</sup>, Ni<sup>2+</sup>, Fe<sup>3+</sup>) by activated carbon fibers and carbon fibers modified. Experiments were conducted to determine the amount of impurities in the activated carbon fibers. Determined the elemental composition of the sorbents, as well obtain the basic sorption characteristics of sorbents.

*Keywords:* activated carbon fibers, modified carbon fiber, sorption, heavy metal ions

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**THERMAL SHRINKAGE FORECASTING  
OF THE TEXTILE THERMOCONTRACTING  
TUBE ON THE BASIS OF THREADS  
COMPOUNDING IT**

Contraction size change of a thermocontracting tube with a form memory effect and components-threads compounding it in temperature range 100–200 °C is considered. The model, allowing to predict size of transverse contraction of the tube depending on number of longitudinal threads is offered. Theoretical and experimental data comparison is effected.

*Keywords:* thermocontracting textile tube, transverse shrinkage, longitudinal shrinkage, the form memory effect, modeling, modified polyolefin monofilament, polyethylene terephthalate monofilament

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**THE INFLUENCE OF CARBON  
NANOSTRUCTURES ON  
POLYACRYLONITRILE CARBONIZATION**

Carbonization of film and fibrous composite materials with carbon nanofillers was investigated. Maximum of carbon yield in argon ambience is at 10 wt. % filler content. Carbon crystallite germinal structures in the temperature range 400–520 °C were observed, both for film and fibrous composites.

*Keywords:* Polyacrylonitrile, carbonization, fiber, carbon nanostructures, carbon black, carbon nanotubes, graphite

**E. V. Saklakova, V. A. Glecova,  
O. V. Astashkina, A. A. Lyssenko**

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**MODIFICATION ACTIVATED  
CARBON FIBERS BY NANO- AND  
MICROPARTICLES OF BISMUTH**

The article describes the adsorption of bismuth on activated carbon fibers. The dependence of the sorption capacity of the initial concentration, time and temperature of sorption were determined. The analysis of the properties of activated carbon fibers before and after modification of bismuth were investigated.

*Keywords:* adsorption, activated carbon fibers, bismuth

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**PROTECTIVE FILTERING-SORBENT  
MATERIAL WITH THE INTRODUCTION  
OF NANOSCALE TITANIUM DIOXIDE**

Developed protective filtering-sorbent material with embedded nanoscale titanium dioxide anatase crystal-line form with a particle size of 10–15 nm. An aqueous dispersion of titanium dioxide (sol) and nanostructured titanium-silicate composition for application to teksil-nuyu basis. The high photocatalytic activity of the filter sorbent material.

*Keywords:* photocatalytic activity, nanoscale titanium dioxide, hydro-rozol silica samodegazatsiya

**A. S. Stepashkina, E. S. Tsobkallo,  
O. A. Moskalyuk**

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**ELECTROCONDUCTIVITY OF  
POLYPROPYLENE/BLACK CARBON  
COMPOSITES**

The electroconductive composite material based on polypropylene and technical carbon was received. The dependence between resistance and mass fraction of filler was investigated. It was shown that different parts of the received experimental dependences can be described by means of the theory of mixture and the theory effective.

*Keywords:* composite material, polypropylene, technical carbon, antistatic effect, resistance, Likhtenekker's theory, logarithmic theory of mixture, Bragg-Williams's theory, theory of the effective environment, Bruggeman's model, Maxwell-Garnett model

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**RESEARCH OF POLYLACTIC ACID  
POLYCONDENSATION IN THE PRESENCE  
OF THE CAPROLACTAM**

Polycondensation of lactic acid in the presence of a caprolactam is considered. Properties of the received copolymers are studied.

*Keywords:* lactic acid, caprolactam, synthesis, copolymer, characteristic viscosity

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**USING THE BIOCIDAL AGENT OBTAINED  
FROM PROCESSED  
WOOD PRODUCTS FOR FINISHING OF  
COTTON MATERIALS**

The effect of the organic antimicrobial and antifungal agent, obtained from processed wood products, was determined. The mass transfer of biocide agent in the solutions of isopropyl alcohol in the heterogeneous processes of sorption in the cellulose fibers, with using UF, IR and spectroscopy in visible range; dynamic thermogravimetric analysis and differential scanning calorimetry were investigated. The assumption of the mechanism of fixing of the biocidal agent is made.

*Keywords:* biocidal agent, cellulose fibers, mechanism of fixing, consumer properties

**I. O. Tsybuk, E. I. Tyrkin, A. A. Lyzenko,  
N. S. Lukicheva**

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**ADSORPTION OF DYES ON THE  
TITANIUM DIOXIDE NANOPARTICLES**

The article discusses some aspects of adsorption of various dyes on the surface of the photocatalyst titanium dioxide. Was shown how an absorption time and an acidity of solutions influence on the amount of dyes' adsorption.

*Keywords:* titanium dioxide, adsorption, dyes, photocatalysis.

**E. P. Shirshova, O. V. Astashkina,  
M. O. Basok, A. A. Lysenko**

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**THERMAL PROPERTIES OF FIBER  
POLYOXADIAZOLE, COLORED IN THE  
MASS**

In the article the analysis thermogravimetric polyoxadiazole fibers dyed with disperse dyes heat resistant. The influence of particles of different nature on the structure of the polymer matrix in the thermo-oxidative breakdown. The dependence of the properties of the dispersed dye and heat polyoxadiazole fibers.

*Keywords:* polyoxadiazole, thermogravimetric analysis of the differential thermal analysis, heat-resistant dyes, thermal-oxidative breakdown.

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**INVESTIGATION OF THE INFLUENCE  
OF PHYSICO-CHEMICAL METHODS OF  
MODIFICATION OF FILLED THE ADHESIVE  
EPOXY COMPOSITION**

Possibility of directed regulation of physico-mechanical, physico-chemical properties of epoxy composites, due to the introduction of nanoscale fillers and the use of different types of physical modification of the composite material to give it a range of new physico-chemical and higher physico-mechanical properties, which expands the range of their application was shown.

*Keywords:* Epoxy oligomer, modification, reduction of flammability, physico-mechanical and physico-chemical properties

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**HYBRID FILLERS — FIRE RETARDANTS  
IN OF EPOXY COMPOSITIONS  
COMBUSTIBILITY**

In this paper the capability to serve as hybrid fillers epoxy oligomer — sodium silicofluoride (NKF) and ammonium polyphosphate. The developed compositions classified as nonflammable and are characterized by high physical and mechanical properties.

*Keywords:* Epoxy oligomer, plasticizers, filling, flammability, physical and mechanical properties