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OPTICALGLASSWITH AHIGHREFRACTIVE INDEX IN THE SYSTEM $La_2O_3–Al_2O_3–B_2O_3–SiO_2$

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The effect of modifying oxides on the glass-forming ability and properties of glasses of the system $La_2O_3–Al_2O_3–B_2O_3–SiO_2$ (LABS) has been studied. When modifying the LABS system, it is possible to achieve high refractive index (n_D = 1,81) while savening an acceptable crystallization ability to obtain overall optically homogeneous glass samples. Synthesis of multicomponent glass in volume of 300 ml using optical glass-making methods confirms the promising nature of this composition.

CHEMICAL COMPOSITION OF THE INNER SURFACE AND STRUCTURE OF THE SILICATE MESOPOROUS GLASSES

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The comprehensive study of porous glass structure by adsorption methods (weight methods and nitrogen desorption at 77 K), as well surface active centers (by selective adsorption of acid-base indicators with specified characteristic pKa values and using IR spectroscopy) and thermal transformations and thermal effects during heating of porous glasses (by complex thermal analysis), depending on the temperature of heat treatment of porous glass in the range of 120 - 750 °C has been carried out.

DEPENDENCE OF NONLINEAR REFRACTIVE INDEX OF LASER AND OPTICAL GLASSES ON THEIR OPTICAL CONSTANTS

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Laser and a thermal optical glasses were studied which are used, respectively, for manufacture of large-size active elements and "white optics" elements of powerful pulse radiation amplifiers. The dependence of the nonlinear refractive index (NRI) on their optical constants was determined. It is shown that the NRI of the above glasses will not exceed $1.20*10^{13}$ cm^2/B^2, being the lower, the higher their dispersion coefficients and the lower the refractive indices and the average dispersions.

SYNTHESIS OF GLASS BASED OM IRON-CHROMIUM SLUDGE

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In this paper, we consider the problem of utilization of iron-chromium sludge obtained in the process of monochromatic production. A method for solving this problem is proposed: the use of sludge as the main raw material in the production of glass. Studies have shown that to obtain high-quality glass, it is necessary to use additional raw materials.

DEVELOPMENT OF GLASS COMPOSITIONS THAT ARE INERT TO THE DESTRUCTIVE EFFECK OF MICROMYCETES

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The study of phosphate glasses showed that the most inert to the effects of micromycetes are glasses containing aluminum, boron, calcium, lanthanum and zinc oxides. As a result of the study, it was found that the most chemically stable glasses are those that contain cations with a higher field strength and high polarizing ability, mainly three-charged cations or cations with an easily deformable outer electron shell, which have high polarizability.

Mn^{4+} CONCENTRATION EFFECT ON SPECTRAL PROPERTIES OF LITHIUM-GERMANATE GLASS-CERAMICS

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The report presents the results of the spectral properties study of lithium-germanate glass-ceramics doped with Mn ions. The glass transition temperature is 490°C, and the crystallization temperature is 560°C. Isothermal treatment at 560°C leads to the nucleation of $Li_2Ge_7O_{15}$ crystals in the matrix. When irradiated with light from 250-400 nm range, glass-ceramics produces red luminescence with a maximum at 667 nm, which corresponds to tetravalent manganese ions in a crystalline environment.

OBTAINING OF GLASS COMPLEX CHARGE OF ITTRIUM-ALUMINOSILICATE GLASSES FOR RADIOTHERAPY BY MICROWAVE METHOD

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A microwave method for the synthesis of YAS glass charge has been developed. The synthesis was carried out by the interaction of solutions of yttrium nitrate, aluminum sulfate and sodium

silicate. The melting time of the synthesized charge is reduced by half, and the temperature is reduced by 50°C. The obtained glasses can be used in radiotherapy and diagnostics. The conducted studies show the effectiveness of the synthesis of MV complex glass charge and glass based on it.

THE MOSSBAUER STUDY OF AMORPHOUS FILMS DEPOSITED FROM SOLUTIONS OF CHALOGENIDECHALCOGENIDE GLASSES IN N-BUTYLAMINE

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The local surrounding of atoms in amorphous films CuI-AgI-As_2Se_3 deposited from solutions of glasses in n-butylamine has been studied. It was found, that atoms in chemically deposited chalogenidechalcogenide films are analogous in the local surrounding of atoms in the initial glasses.

METAL-SEMICONDUCTOR STRUCTURES IN NANOPOROUS GLASS FOR WATER SPLITTING

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Water splitting is one of the different ways of using solar energy. Under the action of sunlight it is possible to obtain gaseous oxygen and hydrogen depending on the material used. Photocatalytic water splitting consists in the reactions of hydrogen reduction and water oxidation by electron-hole pairs formed by photogeneration in IR and visible spectrum. Nanostructured materials have a higher active surface-to-volume ratio. There is a perspective of using such materials as photocatalysts.

ABOUT CORRELATION BETWEEN THE USE OF THE COMPONENTS OF THE MAGNETIC SENSITIVITY OF VALENT ELECTRONS AND THE ALGORITHM OF SEARCHING FOR GLASS-LIKE AND CRYSTALLINE DIAMAGNETS OF THE NANOMETER RANGE USED IN MEDICINE

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Based on the analysis of the magnetic properties of weakly magnetic inorganic materials, some possibilities have been expressed and proposed about the preferable use of a number of inorganic materials of the nanometer range for use in medicine and oncology. This approach is based on the fundamental ratio of the components of the magnetic susceptibility of valence electrons for inorganic materials, including semiconductors, ionic crystals, glasses, and others.

CHEMICAL STABILITY AND MECHANICAL PROPERTIES OF FLUOROPHOSPHATE GLASSES WITH VARIOUS CONTENTS OF BARIUM METAPHOSPHATE

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The strength and water resistance of fluorine phosphate glasses at various concentrations $Ba(PO_3)_2$ were investigated.
It is stated that an increase in the concentration of phosphates increases the water drainage of glasses, but reduces their mechanical strength.

MODIDIED FLUOROZIRCONATE GLASS, DOPED WITH RE AND TRANSITION ELEMENTS

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RE-activated fluorozirconate glasses with a broader IR transmission range compared to oxide glasses appeared to be a promising material for creating sources of coherent radiation in a wide spectral range from UV to mid IR. At present, manganese-doped red phosphors are of great interest for LED sources emitting warm white light. It was found that partial substitution of fluorine with chlorine causes a redshift of the Mn^{2+} emission band up to 590-630 nm, depending on the concentration of chlorine.

INVESTIGATION OF THE INFLUENCE OF BORON OXIDE CONCENTRATION ON THE SPECTRAL PROPERTIES OF ALKALI-ALUMINA-BORATE GLASS CERAMICS WITH CHROME

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This work is devoted to the study of the influence of boron oxide concentration on the luminescent properties of trivalent chromium ions in alkali-alumina-borate glass ceramics. The optical density spectra and luminescence spectra of the studied materials with various concentrations of additives were obtained. The dependences of the lifetime and quantum yield of chromium ions luminescence on the content of boron oxides in the glass composition are also presented.

INFLUENCE OF THE COMPOSITION OF THE NUCLEATING AGENT ON THE STRUCTURE AND OPTICAL PROPERTIES OF GLASS-CERAMICS BASED ON MAGNESIUM ALUMINATE SPINEL DOPED WITH FERROUS IONS

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Glasses of the $MgO–Al_2O_3–SiO_2$ system nucleated by titania or a mixture of titania and zirconia and doped with 0.1 mol% FeO were prepared by the melt-quenching and secondary heat-treatments at 750 – 1300 °C. The structure of glasses and its transformation with heat-treatment were studied by DSC and XRD analyses. Optical properties were studies using optical spectroscopy. Transparent glass-ceramics with broadband absorption of Fe^{2+} ions in the range of 2000 nm were prepared for the first time.

APPLICATION OF METALLIC GLASSES FOR IMPROVEMENT OF ELECTROTECHNICAL DEVICES

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At present there are being applied two types of metallic glasses: amorphous and nano-crystalline tapes. It permits to modify the design and technological process of manufacturing of electro-technical devices, based on utilization of high-temperature superconductors. As a result there appear new versions of electrical machines and transformers, operating at cryogenic temperatures.

THE DECORATION OF GLASS BRACELETS FROM TAURICCHERSONES (PRELIMINARY RESULTS)

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The glass body and painted decorations of twenty two glass Byzantine bracelet fragments (found in TauricChersonesos, 10^{th}-13^{th} centuries A.D.), has been investigated using OM (22 pcs), XRF (21 pcs), SEM-EDS (7 pcs) and XRD (1 pcs). The obtained chemical compositions indicated that the chromophores of glass body and decorations were cobalt, manganese, copper, iron, tin, gold and silver. One of the mineral pigments of external decorations were red ochre and lead-tin yellow (II) ($PbSn_2SiO_7$).

LUMINESCENT GLASSES BASED ON LITHIUM TETRABORATE DOPED WITH RARE EARTH ELEMENTS

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The absorption, excitation, and photoluminescence spectra of glasses based on lithium tetraborate doped with Eu^{3+}, Sm^{3+}, and Gd^{3+} have been measured. The effect of co-doping with two rare-earth elements (Eu^{3+} and Gd^{3+}, Sm^{3+} and Gd^{3+}) on the excitation and photoluminescence spectra is considered. A diagram of the energy levels of impurity rare-earth ions in the studied glasses is proposed. A possible channel of energy transfer from Gd^{3+} ions to Eu^{3+} and Sm^{3+} ions is shown.

THE MICROHETEROGENEOUS STRUCTURE OF K_2O-PbO-SiO_2 GLASSES BY BRILLOUIN AND RAYLEIGH SCATTERING-SPECTROSCOPY

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The group of eight glasses in the $9.5K_2O \cdot xPbO \cdot (90\text{-}x)SiO_2 \cdot 0.5CuO$ (x = 10.1, 19.0, 27.0, 38.0, 47.3, 52.1, 56.8, 61.4 масс %) has been synthesized. The Brillouin and Rayleigh scattering was measured using 532 nm laser. The dependence of Landau-Placzek ratio on PbO content correlates with the position of the liquidus on the polythermal section of the phase diagram. The nanoheterogeneous structure of glasses with elevated Landau-Placzek ratio is confirmed by TEM.

THE ATRIBUTION OF RUSSIAN GLASS BY ARCHEOMETRIC STUDIES OF THE GLASS FACTOTY ON LAVA RIVER

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In 2020, the location of a glass factory worked from 1725 to 1755 was discovered on the Lava River in the Southern Ladoga area. The glassesare divided into three groups. The group 1 is potash glasses with small amounts of PbO, As_2O_3, MnO_2 and sometimes CoO. The group 2 is potash glass containing PbO and Na_2O, usually of blue or pale green color. The group 3 is ash glass, sometimes with small amount of PbO.

STRUCTURAL CHARACTERISTICS AND PHYSICO-CHEMICAL PROPERTIES OF GLASSES FOR RIGID OPTICAL FIBER

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The work is devoted to the actual problems of obtaining glasses for the light-guiding core, reflective and protective coats that are resistant to crystallization in the temperature range of

600–1050°C and are consistent with each other in terms of a complex of optical, thermophysical and technological characteristics. The glasses of the developed compositions can be used in the production of fiber-optic products.

INFLUENCE OF SOME 3D- AND 4F-ELEMENTS ON THE STRUCTURE AND ELECTROPHYSICAL PROPERTIES OF ALKALINE BOROSILICATE GLASSES

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The results of studying the electrophysical properties of alkaline borosilicate glasses modified by La_2O_3, ZrO_2 and TiO_2 are presented in this work. The influence of the cation field strength on the formation of the glass structure, which determines the degree of its interaction with the electromagnetic radiation of the microwave range, is shown. It was found that the introduction of TiO_2 contributes most to the reflection of electromagnetic radiation in the microwave range.

GLASS-CERAMICS AND OPTICAL CERAMICS BASED ON ZnO

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Optical ceramics were obtained by uniaxial hot pressing in vacuum. ZnO-based transparent glass ceramics were obtained by the melt-quenching and secondary heat-treatments. The structure and optical properties of ZnO ceramics and GCs were studied using X-ray diffraction, DSC, SEM, EDX, Raman, X-ray and optical spectroscopy. The results will be used in the development of new transparent optical ceramics and glass-ceramics based on ZnO promising for the development of optoelectronic devices.

THE OLD RUSSIAN POTASH-LEAD GLAS AS PREDECESSOR OF MODERN DOMESTIC CRYSTAL

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It is commonly accepted that potash-lead glasswas invited in England in XVII cen. Became of useful properties this domestic crystal is now widely used for glassware production.However, the glass of this type was intensively usedin medieval (XI-XIIIcen.) Russia for production of beads, bracelets and vessels. Here the production appeared due to the availability of raw materials and the simplicity of technology.

THE PILOT LINE FOR PRODUCE QUARTZ CONCENTRATES FOR OPTICAL QUARTZ GLASS

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The report presents a pilot line for the production of quartz concentrates, created in Irkutsk on the basis of the Institute of Geochemistry. The process of obtaining quartz concentrates for the production of single-component glass is shown on the basis of quartzites from the Bural-Sardag deposit. The characteristics of the obtained concentrates are given in comparison with concentrates from other companies.

EXPANSION OF THE LINE OF DENTAL GLASS CEMENTS

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The influence of raw materials on the reproducibility of glass-crystal materials for dentistry.

INFLUENCE OF THE COMPOSITION OF THE NUCLEATING AGENT ON THE STRUCTURE AND OPTICAL PROPERTIES OF GLASS-CERAMICS BASED ON ZINC ALUMINATE SPINEL NANOCRYSTALS

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Glasses of the $ZnO–Al_2O_3–SiO_2$ system nucleated by TiO_2 or a mixture of TiO_2 and ZrO_2 were prepared by the melt-quenching and secondary heat-treatments at 720 – 1050 °C. The structure of glasses and its transformation with heat-treatment were studied by XRD analyses. Optical properties were studies using optical spectroscopy. Influence of the composition of the nucleating agent on the structure and optical properties of glass-ceramics based on zinc aluminate spinel nanocrystals was revealed.

ELECTROKINETIC CHARACTERISTICS OF NANOPOROUS VITREOUS MATERIALS IN SOLUTIONS OF SIMPLE ELECTROLYTES.

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Electrokinetic properties (efficiency coefficient α and electrokinetic potential ζ) of micro- (MIP) and macroporous vitreous membranes (VM) were studied in solutions, contained singly-, two- and triple-charged counterions. The obtained results were compared with α and ζ determined for VM doped with Fe_3O_4 and AgI. The structure of secondary silica, depending on the type of counter ion, was found to have a determining impact on the relation between electrokinetic characteristics of MIP membranes.

PLASMA-FREE ION SOURCE

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Ion-conducting glasses AgI-Ag_2CrO_4, AgI-$Ag_2Cr_2O_7$, AgI-GeS_2-Sb_2S_3 were obtained by melting in evacuated quartz ampoules. Such glasses will become the basis for creating efficient solid-state ion engines for ultra-small satellites. The glass transition temperatures, the activation energies and other physical and chemical characteristics were prepared for the studied glasses.

FORMATION OF ANISOTROPIC BIREFRINGENT STRUCTURES INSIDE NANOPOROUS GLASS BY FEMTOSECOND LASER PULSES

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The formation of birefringent structures inside nanoporous glass by femtosecond laser pulses was investigated. The laser-modified region is shown to be a cavity whose shape depends on the number of pulses. A possibility of multidimensional data recording inside nanoporous high-silica glass. Outstanding thermal stability of data storage in the NPG is confirmed by the 24 h long heat treatment at 700 °C.

EFFECT OF STRUCTURAL RELAXATION ON CRYSTAL NUCLEATION IN GLASSES

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The effect of structure relaxation of the supercooled glass-forming liquid on the crystal nucleation kinetics is considered in the framework of the classical nucleation theory. It is shown that the evolution (increase) of the nucleation rates with time is mainly determined by the long structural relaxation of the glass towards the metastable supercooled liquid, which occurs simultaneously with the nucleation process.

MORPHOLOGICAL FEATURES OF MULLITIS OBTAINED BY THE PLASMA METHOD

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In this work, mullite-containing products of melting of enriched kaolin and technical alumina obtained in a low-temperature plasma environment were investigated. Electron microscopic studies of a transverse section show that the melt product has a parallel-fibrous structure, while filamentary crystals penetrate the glass-phase region.

EFFECT OF THE ADDITION OF YTTRIUM OXIDE ON THE SPECTRAL PROPERTIES OF BISMUTH-CONTAINING COMPOSITE MATERIALS BASED ON SILICATE POROUS GLASSES

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Bismuth-containing composites with a variable content of yttrium oxide were synthesized by an impregnation of the silica porous glasses with water-salt solutions of $Bi(NO_3)_3 \cdot 5H_2O$ in the presence of $Y(NO_3)_3 \cdot 6H_2O$. Composites were studied by UV-VIS-NIR, luminescence, and energy-dispersive X-ray spectroscopy. The influence of the composition (the concentration of introduced bismuth and yttrium) and the heat treatment mode of composites on their spectral properties are established.

SPECTRAL PROPERTIES OF COMPOSITE MATERIALS BASED ON SILICATE POROUS GLASSES DOPED BY SILVER AND ERBIUM IONS

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Composites with a variable content of silver and erbium ions were synthesized by an impregnation of the high-silica porous glasses (8V-NT and NFF) with water-salt solutions of $AgNO_3$ in the presence of $Er(NO_3)_3 \cdot 5H_2O$. Composites were studied by luminescence, UV-VIS-NIR, and energy-dispersive X-ray spectroscopy. The influence of the composition (the concentration of introduced silver and erbium) and the heat treatment mode of composites on their spectral properties are established.

STUDY OF THE POSSIBILITY OF GLASS-CRYSTALLINE GEOPOLYMER MATERIALS SYNTHESIS

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The possibility of obtaining geopolymer materials based on TPP ash and slag waste by low-temperature technology was considered. Two series of compositions based on fly ash and slag and the synthesis technology were developed. The processes of a porous structure formation during of geopolymer materials synthesis were described. It was found that the most effective foaming additive is metal aluminum powder. Promising methods of increasing the porosity of synthesized geopolymers were described.

INFLUENCE OF PRE-CRYSTALLIZATION HEAT TREATMENT ON THE EFFICIENCY OF LUMINESCENCE OF GALLATE GLASS-CERAMICS

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The present study summarizes the existing and newly obtained results of pre-crystallization heat treatment influence on the spectral-luminescent properties of the glass-ceramics synthesized in the Me_2O-Ga_2O_3-XO_2 system (Me = Li, Na; X = Si, Ge), also including small addition of Al_2O_3 or NiO. Developed glass-ceramics seem to be attractive candidate materials for fabrication of UV-C radiation viewers and fiber amplifiers in the near-IR region.

THERMODYNAMIC CALCULATION OF THE MELTING PROCESS OF SILICON-CONTAINING WASTE

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Redox processes during melting in the Al-C-Ca-Fe-K-Mg-Mn-Na-P-Si-Ti-B-Cr-F-N-H-O system have been investigated. The method of physicochemical modeling is implemented, based on the determination of the global minimum of the Gibbs energy of the modeled system on a set of constraints set by the system of mass balance equations. The results of the equilibrium composition of the system depending on the melting point are presented.

OBTAINING OF BUILDING MATERIALS BY UTILIZING WASTE OF SILICON-CONTAINING ROCKS USING MICROWAVE HEATING

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The purpose of this work is to study the possibility of utilizing rock waste to obtain heat-insulating structural concretes using microwave activation. Chemical, X-ray phase and IR-spectroscopic analyzes were carried out in order to identify the processes occurring during microwave heating. Synthesis was carried out by microwave treatment in the power range from 160 to 600 W at different exposures. Compositions of materials have been developed. The modes of heat treatment are established.

THERMAL CONDUCTIVITY OF POROUS GLASS SATURATED WITH FLUID

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There are given the results of experimental investigation of the effective heat conductivity of the porous glass, saturated by n-hexane in the temperature interval 290-370K and at the pressions 0.1MPa and 10MPa. There are studied the mechanisms of heat transfer in heterogeneous systems and the influence of n-hexane, of temperature and pressure on the behavior of effective head conductivity of the porous glass, saturated by the fluid.

CHARACTERISTIC OF THE COMPOSITION AND STRUCTURE OF RARE-EARTH-DOPED SILICATE GLASS CORES OF OPTICAL FIBERS

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The elemental distribution, phase separation and nanocrystallization process in rare-earth-doped silicate preforms and optical fibers were studied. The maximum achievable concentrations for different doping elements and the associated advantages of samples were considered. Two types of phase separation were revealed: droplet separation and the formation of two interpenetrating glass phases. Phase separation of the second type can be accompanied by the formation of nanocrystalline inclusions.

STUDY OF CHLORIDE PHOTO-THERMO-REFRACTIVE GLASSES WITH VARIABLE SILVER CONCENTRATION

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In this work, at the first time, a new class of PTR glasses was studied - chloride PTR glasses containing fluorides. In this glass it is possible to increase the concentration of silver in comparison with conventional PTR glass. It leads to increase of silver nanoparticles concentration in holograms, which can be useful for further reducing scattering. Holograms recorded in the glass are phase and have refractive index modulation amplitude values not less than in conventional glass.

STRUCTURE AND PROPERTIES OF ALKALI-ACTIVATED GRANULATED BLAST FURNACE SLAG-BASED COMPOSITES

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This study aimed to investigate the mechanical behavior and microstructure of an alkali-activated granulated blast furnace slag-based matrix reinforced with chopped reclaimed carbon fibres (RCFs) coming from the aircraft industry carbon fiber reinforced plastics waste. The experimental results showed that the incorporation of 0.7 vol. % RCFs had an optimal influence on mechanical behavior and microstructure of composite.

BEHAVIOR OF REINFORCING BASALT FIBERGLASS IN CALCIUM-PHOSPHATE CEMENTS WITH VARIOUS MIXING LIQUIDS

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The behavior of reinforcing silicate glass fiber based on basalt in calcium-phosphate cements based on $CaHPO_4$ obtained from $Ca_3(PO_4)_2$ using various (aqueous solutions of H_3PO_4, $Mg(H_2PO_4)_2$, $Ca(H_2PO_4)_2$) mixing liquids has been investigated. Good adhesion of the phases formed during the setting of cement to the fiber surface, as well as the chemical interaction of the fiber with the liquid phase of the cement material is shown.

INFLUENCE OF FEATURES OF THE STATE DIAGRAMS OF GLASS-FORMING SYSTEMS ON THE PHASE COMPOSITION AND PROPERTIES OF SITALS

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The study shows regularities of the relationship between the state diagram of a glass-forming system and glass-crystalline materials, which are composite materials.The article studies the processes of directional crystallization of pseudo-binary systems' glasses, with incongruent melting of one component and limited solubility of the components in the solid phase in the $CaMgSi_2O_6$-Al_2O_3, $MgO{\cdot}Al_2O_3$-SiO_2-B_2O_3 systems. Some physicochemical properties of glass-ceramics have been studied.

PROPERTIES OF NANOSIZED AgI LAYERS IN A CHALCOGENIDE GLASS MATRIX.

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Composite films based on glass $(GeSe_2)_{30}(Sb_2Se_3)_{30}(AgI)_{40}$ and crystalline AgI have been synthesized, which have a specific conductivity at 293K of 0.3 S cm-1 at an activation energy of conductivity of 0.07 eV. It was found that when heated, reflexes of an unknown phase appear, which then persist. Quantum-chemical calculations confirmed the possibility of the existence of a structure formed by 4 monatomic planes, two outer ones are formed by iodine atoms, two inner ones - by silver atoms.

LASER SYNTHESIS OF NANOMATERIALS FOR CRIMINALISTIC TECHNOLOGY ON GLASS-SHAPED AND GLASS-CRYSTAL SUBSTRATES

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It is shown that heterophase glass-crystalline materials based on silicon oxide give the best results when used as substrates for creating micro-sized sensors by laser-induced deposition.

Conducting copper microtracks with different morphologies determined by the substrate material are demonstrated.

PHYSICO-CHEMICAL AND SPECTRAL LUMINESCENT PROPERTIES OF GLASSES COACTIVE WITH YTTERBIUM AND THULIUM IONS

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We synthesized glasses with a variable content of thulium ions in the5Ba(PO3)2– (90-x)(AlF–CaF2 –MgF2 – BaF2 – SrF2) 5.0 YbF3–xTmF3 system. an analysis of the spectral-luminescent characteristics is carried out by comparing of the experimental results and calculations based on the Judd-Ofelt theory.

FLUOROPHOSPHATE GLASSES WITH NANOCRYSTALS OF PEROVSKITES

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The optimal compositions of glasses for the growth of CsPbX3 quantum dots (X = C1, Br, I) were determined. An analysis of XRD proved the formation of CsPbX3 (X = Br, I) quantum dots Spectral-luminescence measurements have demonstrated the shift in the emission band from 450 to 700 nm.

DEVELOPMENT OF RESEARCH ON QUARTZ GLASS

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The history of the development of quartz glass research from 1817 to the present is described. The features of obtaining transparent (on the example of KC-4B at the Institute of Silicate Chemistry 2000 year) and opaque quartz glass are considered. Opaque quartz glass is produced at the enterprise Open Joint Stock Company "Pervouralsky Dinasovy Zavod" (JSC "DINUR" 2021 year).

GLASS-FORMING SYSTEM NA_2O-B_2O_3-SIO_2-FE_2O_3: PHASE SEPARATION, CRYSTALLIZATION AND PHYSICAL AND CHEMICAL PROPERTIES

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Glasses in the Na_2O-B_2O_3-70SiO_2-Fe_2O_3 system were studied by dilatometry, XRPD, SEM and Mössbauer spectroscopy, along with the investigation of their leaching behavior in aqueous 3M

HCl solution. The metastable immiscibility region and magnetite and $FeSiO_3$ crystallization fields were outlined for 550°C. It was found that to obtain a porous glass containing magnetite after leaching, the phase-separated glasses where Fe^{3+} cations are octahedrally coordinated are required.

MOLYBDENUM IN SODIUM-CESIUM-STRONTIUM BOROSILICATE GLASSES

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The solubility of molybdenum as a function of chemical composition has been investigated in sodium-cesium-strontium borosilicate glasses with compositions used for the immobilization of radioactive waste. It was found that the most of material in all samples after synthesis and annealing is glass. Crystallization processes are limited by the formation of alkaline molybdate phases. These processes are more pronounced in samples with a low strontium and cesium content after annealing.

STUDY OF THERMAL STABILITY OF MANGANESE-BEARING ALUMINOPHOSPHATE GLASS AT SOFTENING TEMPERATURE

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Thermal stability of manganese-bearing glass was investigated at a softening temperature of 450 °C. It has been established that this temperature initiates partial glass crystallization. According to Federal Rules and Regulations NP-019-2015 changes in structure of matrix material are completely ruled out at thermal testing. Consequently, HLW storage temperature (and, therefore, the annealing temperature at thermal testing of simulated glass) must be below the softening temperature.

PHYSICAL AND CHEMICAL PROPERTIES AND STABILITY OF ALUMINA-SILICA GLASS SEALANTS FOR SOFC

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Solid oxide fuel cells (SOFCs) are considered as promising electricity sources. Elements of such constructions are usually connected with glass seals, which must have thermal and chemical compatibility with the functional materials of SOFCs. Moreover, the compatibility should persist under working conditions, including high temperatures and long lifetime. In this

work long-term crystallization process and behavior of promising glass seal in contact with functional materials were investigated.

PRODUCTION AND PROPERTIES HALOGEN-CHALCOGENIDE AND OXYHALOGENIDE SEMICONDUCTOR AND DIELECTRIC GLASS

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Based on the developed and modernized methods for the synthesis of chalcogenide semiconductor glass containing active and volatile components, compositions containing fluorine, chlorine, bromine and iodine, as well as compositions of oxyhalide glass, were obtained and investigated optical properties, EPR spectra, density, microhardness, dielectric constant, glass transition temperature and crystallization.

NEW DATA IN MEDIEVAL LADOGA GLASSWORKING

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Excavations in Staraya Ladoga have revealed a glass workshop complex, comprising of fragments of raw glass, evidence of glass melting process, and flawed items. At the same complex a spall of sintered several glasses of yellow, blue and blue-green colors. The analysis (SEM-EDX) was used to identify the chemical composition of the glasses of sinter. As a result, it can be assumed that some of the glass in the sinter could have been produced from local raw materials found in Ladoga place.

INVESTIGATION OF LITHIUM AND ANTIMONY CONCENTRATION EFFECT ON THE SPECTRAL PROPERTIES OF ALKALI-ALUMINA-BORATE GLASS CERAMICS DOPED WITH CHROMIUM

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This work is devoted to the study of the influence of lithium and antimony concentration on the luminescent properties of trivalent chromium ions in alkali-alumina-borate glasses and glass ceramics. The optical density spectra and luminescence spectra of the studied materials with various concentrations of additives were obtained. The dependences of the lifetime and quantum yield of chromium ions luminescence on the content of antimony and lithium in the glass composition are also presented.

SYNTHESIS AND PROPERTIES OF BOROSILICATE GLASSES WITH INCREASED CONTENT OF STRONTIUM AND CESIUM OXIDES

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In this study, the physicochemical properties of glasses based on a borosilicate matrix, in the composition: B_2O_3, Li_2O, Na_2O, Al_2O_3, SiO_2, CaO, MnO_2, as well as SrO and/or Cs_2O with a content of 10 to 30 wt.%, are investigated, such as: Assessment of the stability of the express, determination of density, molar volume, Vickers microhardness.
The obtained glasses were examined by X-ray phase analysis, scanning electron microscopy, X-ray spectral microanalysis, and differential thermal analysis.

ELECTROKINETIC CHARACTERISTICS OF VITREOUS MESOPOROUS AND MONOLITHIC MATERIALS MODIFIED WITH NICKEL AND IRON OXIDES AT A CONSTANT SALT BACKGROUND

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A study and comparison of the electrokinetic parameters of nickel-containing glasses in 1:1 and 2:1-charged electrolytes with the parameters of silicate glasses and containing magnetite have been carried out. The pH of the isoelectric point (IEP) increases in the order of silicate, nickel-containing, and iron-containing glass. For silicate and nickel-containing glass in solutions containing a specifically sorbed Ni^{2+} ion, a shift in the position of the IEP to the neutral pH range is observed.

FEATURES OF THE MORPHOLOGICAL STRUCTURE OF GRAINS OF A TWO-COMPONENT (NA_2O; SIO_2) SYNTHETIC RAW MATERIAL FOR THE GLASS INDUSTRY

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The shell of particles of a synthetic raw material for the production of soda-silicate glass obtained by physicochemical activation of quartz grains with sodium hydroxide has been investigated by scanning probe microscopy. It was found that the complex topography of the near-surface shell, both on the surface of quartz grains and in its cavities, contributes to an increase in the reactivity of quartz sands regardless of the shape of the grains.

GLASS AND GLASS MATERIALS IN ENVIRONMENTAL DESIGN

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The article discusses the possibilities of using glass and glass materials in the design of the environment: functional and aesthetic parameters of glass and glass-crystal materials; their role in the technical aesthetics and design of construction objects, architecture and the surrounding object world in the design; physical and chemical bases of the synthesis and processing of glass.

NON-FERROUS GLASS-CRYSTAL MATERIALS BASED ON MAN-MADE INDUSTRIAL PRODUCTS

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The article considers the use of man-made industrial products in the architectural and construction industry on the basis of the conducted research in areas: the study of technological features of the cooking of slag glasses and the production of colored glass-crystal materials from them; the determination of the operational and technical and aesthetic-consumer properties of glass-crystal materials. There are practical recommendations for the introduction of the materials into the industry.

PHYSICO-CHEMICAL BASES OF SITALLIZATION OF HEAT-RESISTANT COATINGS DURING THEIR FORMATION ON THE SURFACE OF NICHROME ALLOYS

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It is revealed that heat-resistant sitall coatings are an effective protection for nichrome alloys from high-temperature gas corrosion. The physicochemical bases of sitallization of heat-resistant coatings during their formation on the surface of nichrome alloys are developed. The phase composition of the "nichrome coating" contact layer is determined. The scheme of physico-chemical processes of synthesis and sitallization of heat-resistant coatings is presented.

IS IT POSSIBLE TO FIND THE PRODUCTS OF THE IZMAILOVSKY GLASS FACTORY IN THE CULTURAL LAYER OF MOSCOW?

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The article presents the results of studying glass fragments from a pit discovered during excavations on the territory of the Old Gostiny Dvor in Moscow. The author substantiates the assumption that some types of glassware originating from it are the products of the Izmailovsky factory in Moscow (17^{th} century).

EFFECT OF THERMAL ANNEALING ON THE OPTICAL CHARACTERISTICS OF LASER-WRITTEN CRYSTAL-IN-GLASS WAVEGUIDES

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Space-selective laser-induced crystallization of glass is a promising method for the fabrication of channel waveguides of type I in which the core is presented by laser-precipitated crystal having a higher refractive index than the surrounding amorphous cladding. In this study, we investigate and discuss the effect of thermal annealing on optical characteristics of crystal-in-glass waveguides laser-written in lanthanum borogermanate and barium aluminoborate glasses.

APPLICABILITY OF FEMTOSECOND LASER-ASSISTED BACK-SIDE WET ETCHING METHOD TO FORMATION THE HOLLOW CHANNELS INSIDE GLASS AND CRYSTALS

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In this work we investigated femtosecond laser-assisted back-side wet etching of silica glass and yttrium-aluminum garnet crystal in different regimes using 8M NaOH, 8M KOH, 8M KH_2PO_4, 8M H_3PO_4 solutions. It was managed to form channels up to 360 microns length by means of novel multi-pass technique.

ROBUST AND GLUELESS JOINT OF GLASS TO DIFFERENT MATERIALS BY FEMTOSECOND LASER-ASSISTED WELDING

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The potentials of adhesive-free femtosecond laser-assisted welding of dissimilar materials – silica glass with invar alloy, steel and Nd:YAG crystal were investigated. The strong joint

having shear strength of near 26 MPa between materials with close temperature coefficients of linear expansion was demonstrated.

LOCAL LASER-INDUCED CRYSTALLIZATION OF LEAD GERMANATE GLASSES WITH PRECIPITATION OF FERROELECTRIC PHASES

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Laser-induced spase-selective crystallization of glass is a promising tool for precision fabrication of functional crystal-in-glass architectures based on non-centrosymmetic phases. Here, we report direct femtosecond-laser writing of crystalline lines consisting of ferroelectric phase such as $Pb_3Ge_5O_{11}$ inside binary lead germanate glasses. Effect of the laser exposure parameters on the morphology and phase composition of the laser-written tracks is described and discussed.

THE EXPERIENCE WITH USING OF A SCANNING ELECTRON MICROSCOPE FOR INVESTIGATIONS OF GLASSES

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Modern scanning electron microscopesaremultimodal equipment with a plenty of functions: imaging with wide range of magnifications, obtaining of local compositional and crystallographic data, modifying of samples in situ etc. This work focuses on using of SEMs for investigation of different glasses: 1) glass beads age of ~ 200 years from a museum, 2) Bi-doped porous glasses for manufacturing of optical fibers; 3) observation of very thin modified layers on a glass surface.

INVESTIGATION OF SM, EU CODOPING EFFECT ON THE OPTICAL AND STRUCTURAL PROPERTIES OF COMPLEX BOROSILICATE GLASSES

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The present work studies the effects that β-irradiation has on aluminoborosiicate glasses that are co-doped with Eu and Sm ions. The main result is that the simultaneous presence of Eu and Sm ions causes the appearance of non-linear effects when studying the reduction of Eu ions and the creation of the defects. This means that there is an interaction between Eu and Sm ions inside the glass matrix: they behave differently when together from when they are present as single dopants.

TRANSPARENT GLASSES IN THE IR-REGION OF THE SPECTRUM BASED ON OXYFLUORIDE HERMANATE SYSTEMS

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The study shows the development of glasses compositions with high transmittance in the IR region (up to 6.0 - 6.5 μm) of the spectrum based on oxyfluoride germanate systems. The regions of glass formation of the systems $Pb_3Ge_2O_7$-Me_2O_3/MeF_3-PbF_2 (Me-Al, Bi) resistance to crystallization, refractive index (nD-1.660-2.050), dispersion coefficient (ν_D = 55÷25, as well as the concentration of fluorides for dehydration and transmission of the investigated glasses are studied.

INFLUENCE OF SILVER NITRATE CONCENTRATION IN MELT FOR SILVER CLUSTERS FORMATION BY ION EXCHANGE METHOD IN SODIUM-ALUMINOSILICATE GLASS

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A decrease in the silver ions concentration in glass after ion exchange has an extremely weak effect on the set of silver clusters. Silver clusters formed by low-concentration ion exchange method exhibit fast fluorescence and slow phosphorescence. The quantum yield in glass after low-concentration ion exchange was 11%.

TECHNOLOGY OF CREATING LOCAL GRADIENTS IN GLASSY MATERIALS

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The work is devoted to the local modification of a glassy material by means of diffusion processes. The paper presents the motivation for the choice of highly mobile modifiers for the studied glass-forming system. The choice of the optimal glass compositions for testing the technologies of sample modification is discussed. The results of experiments on the creation of gradient structures by local action on a glassy material are presented.

TECHNOLOGICAL FEATURES OF OBTAINING GLASS-CRYSTAL MATERIALS BASED ON DIFFERENT AMORPHOUS ROCKS

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The possibility of using amorphous rocks in the production of glass-crystalline materials is shown, which is expedient both from an environmental and economic point of view. An assessment of the reactivity of amorphous siliceous rocks (diatomite, perlite, tripoli) and raw mixtures developed on their basis has been carried out.

OPTICAL AND ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY OF MANGANESE IONS IN FLUOROZIRCONATE GLASSES

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The luminescence and EPR spectra of fluoride and fluoride-chloride zirconate glasses doped with various manganese compounds were studied. The emission from Mn^{2+} ($^4T_1$ (G)$\rightarrow{}^6A_1$) transition is observed, regardless of the oxidation state of Mn in the initial dopant compound. Manganese ions in the glasses are mainly clustered. The difference in the luminescence and EPR spectra of fluoride and fluoride-chloride glasses is explained by a change in the structure of the local environment of the Mn^{2+}.

INVESTIGATION OF THE STRUCTURAL AND LUMINESCENCE CHARACTERISTICS OF Gd_2O_3:Nd POWDERS SYNTHESIZED BY THE SOL-GEL METHOD

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Nanocrystalline Gd_2O_3: Nd^{3+} materials were synthesized by a low-temperature citrate sol-gel method using polyvinylpyrrolidone as a stabilizer. The data of IR spectroscopy and DTA-TG analyzes show that the formation of Gd_2O_3 particles begins at the stage of the raw gel and the evolution process develops during the drying and heat treatment of materials. The obtained Gd_2O_3: Nd^{3+} materials exhibit intense photoluminescence in the UV and near-IR spectral regions and can be used as nanoscale phosphors.

LASER WRITING OF INTEGRATED WAVEGUIDES IN A THERMOSTABLE LITHIUM ALUMINOSILICATE GLASS-CERAMIC BY LOCAL AMORPHIZATION

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Transparent glass-ceramics belong to the most important hybrid optical materials. In the latest decade, significant progress in the field of laser technology promoted increasing attention to the method of space-selective modification of transparent materials by means of laser irradiation. In this study, we developed a technique of direct laser writing of depressed-cladding channel waveguides in thermostable lithium aluminosilicate glass-ceramic by its local laser-induced amorphization.

CRYSTALLIZATION OF QUARTZ GLASS

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The temperature of the onset and the kinetics of crystallization is one of the most important characteristics of quartz glass, which determines the possibility of its use for the manufacture of high-temperature quartz ceramics. According to the results of the work, it was established that the temperature of the onset and the kinetics of crystallization of quartz glass depends not only on the purity of quartz concentrates, but also is determined by the genesis of the original quartz.

EFFECT OF LOCAL STRUCTURE OF QUARTZ GLASSES ON THE LUMINESCENCE OF GE-CENTERS

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The local structure in silicate glasses is generally studied by X-ray methods. In this work, it is shown that optical spectroscopy are also highly sensitive to changes in the local structure in quartz glasses obtained from natural quartz of various modifications: α-quartz and cristobalite.

FORMATION OF A GLASS MATRIX BASED ON Si-B-ZrB_2 AND Si-B_4C-ZrB_2 SYSTEMS

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Compositions Si-B-ZrB2 and Si-B4C-ZrB2 were investigated in order to obtain borosilicate glass-forming melt in coatings used to protect graphite products and ceramics. It was found that the synthesized materials can withstand temperatures up to 1400 ° C.

METHOD OF PAIR DISTRIBUTION FUNCTIONS FOR IDENTIFICATION OF STRUCTURAL REARRANGEMENTS DURING VITRIFICATION OF MELTS

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The first sharp diffraction minimum (FSDM) of pair distribution functions contains information on structural changes in amorphous materials at the glass transition temperature, T_g. A method for determining the T_g is to assign it to the onset of kink of FSDM. The proposed method is more sensitive than the Wendt-Abraham criterion (WAC) based on the analysis of diffraction peaks, e.g. it was found that the kink determining T_g for amorphous nickel is almost twice as sharp as the kink of WAC.

TECHNOLOGIES OF LOW-TEMPERATURE SYNTHESIS OF GLASS PHASE IN THE PRODUCTION OF FOAM GLASS AND POROUS CONCRETE AGGREGATES

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The low-temperature synthesis of the glass phase by heating alkaline hydrosilicates obtained by the reaction of active silica of siliceous rocks with alkali metal hydroxides formed the basis for the industrial production of ultra-light aggregates of concrete with a foam glass structure obtained without pre-cooking the glass mass.
It is shown that the primary glass phase is formed, bypassing the melting stage, at temperatures below the glass transition point, starting from 200-300 °C.

LOW-FREQUENCY LIGHT SCATERRING AND SUPERSTRUCTURAL GROUPS IN AKALI BORATE GLASSES

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Low-frequency Raman spectra of M_2O-B_2O_3 glasses (M = Li, Na) were measured in order to check if there is any relationship between the dynamic correlation length, l_c, and the average size of the ordered arrangements of atoms, $<R>$, expressed through the distribution of IRO structures and their representative size. The obtained results showed that IRO structures play important role in the formation of the nanosized areas which are responsible for the origin of low-frequency light scattering.

THE STRUCTURE OF Al_2O_3-PbO-B_2O_3 GLASSES AS PROBED BY RAMAN SPECTROSCPY

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The structure of Al_2O_3-PbO-B_2O_3 glasses was probed by Raman spectroscopy. It was found that in the low B_2O_3-containing (30 mole%) glasses Al_2O_3 acts, mainly, as a network former, whereas the structural role of PbO gradually changes from network forming to modifying as PbO is substituted by Al_2O_3. In the high B_2O_3-containing (65 mole%) glasses, where PbO acts, mainly, as a modifier, aluminum oxide demonstrates dual structural role overall studied compositional range.

MODELLING OF QUARTZ GLASS STRUCTURE BY MOLECULAR DYNAMIC METHOD

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This work is about theoretical estimation of structural difference cristobalite glass and quartz glass and comparison their virtual structures and real ones. Calculations of glass structures were performed by molecular dynamic technique and reaction force field potential (ReaxFF). The LAMMPS program code was used to perform calculations. Beta-quartz and beta-cristobalite were initial structures. Calculated structures was analysed by radial distribution function and angle distribution function.

STUDY OF THE TEMPERATURE EFFECT ON THE OPTICAL PROPERTIES OF PEROVSKITE NANOCRYSTALS IN BOROGERMANATE GLASS

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This work is devoted to revealing phase transitions of perovskite nanocrystals in borogermanate glass by an optical method. The temperature dependence of the 1S exciton intensity was obtained during heating and subsequent cooling of samples with different heat treatments. The melting, crystallization, and hypothetical phase transition temperatures of perovskite nanocrystals were obtained. Results indicate that temperatures of phase transitions depend on the temperature of glass treatment.

GLASS-LIKE FERROMAGNETIC MATERIALS BASED ON BARIUM-BORATE IRONCONTAINING SYSTEM

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The glass formation and properties of the Li_2O-Fe_2O_3-BaB_2O_4 system glasses have been investigated. The magnetic properties appear when content of Fe_2O_3 and Li_2O+Fe_2O_3in system is 30-40 mol.% at a ratio of Li_2O / Fe_2O_3 = 1/1 and 1/5 and reach the maximum values (magnetic permeability 860 units) at a ratio of Li_2O/Fe_2O_3=1/5 and at the concentration of mentioned components equal to 40 mol.%. The TEC, the dilatometric temperature of the strainonset and the density of glasses were explored as well.

STUDY OF MIGRATION PROCESSES AND STRUCTURAL-CHEMICAL FEATURES OF GLASSES OF THE Ag - As - Se SYSTEM AS PROMISING MATERIALS FOR LASER RECORDING OF 3D OPTICAL STRUCTURES

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Physicochemical properties (including electrical conductivity, activation energy, diffusion coefficients and transfer numbers of the Ag+-ion) of glasses of the AsSe – Ag and AsSe1.5 – Ag cross sections have been investigated from the point of view of their structural features. With a silver concentration of more than 5 at. %, the main current carrier changes: the electronic conductivity becomes predominantly ionic, there are no steric hindrances during the migration of Ag^+-ions in these glasses.

CRYSTALLIZATION OF GLASSES IN THE $Na_2O–BaO–B_2O_3$ SYSTEM.

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The crystallization of glasses in the $Na_2O–BaO–B_2O_3$ system was studied by the methods of differential thermal analysis (DTA) and X-ray diffractometry. The region of glass formation of the system was determined, and separate sections of the phase diagram were constructed. The primary crystallization field of the phase $Na_2O·2BaO·9B_2O_3$ is outlined The nucleation of crystals in the monolithic glasses and its effect on the further crystallization were shown by the DTA method.

FORMATION OF NANOGRATINGS IN OXIDE GLASSES UNDER THE ACTION OF FEMTOSECOND PULSES

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In this study, conditions of inscription of birefringent nanoperiodical structures (nanogratings) in the bulk of binary $xR_2O·(100-x)SiO_2$ и $xNa_2O·(100-x)GeO_2$ glasses by the femtosecond laser beam have been investigated. The dependence of optical retardance of the nanograting on the laser pulse number, energy and duration which were applied to inscribe it is determined. The effect of the modifying cation type on the formation of nanogratings is revealed.

FORMATION OF DIFFRACTION GRIDS IN THE Me_2O-SiO_2-Nb_2O_5 (Me = Li, Na, K) GLASSES BY FEMTOSECOND LASER PULSES

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In this work, we study the femtosecond laser modification of Me_2O-SiO_2-Nb_2O_5 (Me = Li, Na, K) glassesand, as a consequence,the formation of diffraction grids. The main goal of the study is the effect of two- and three-photon absorption on local glass modification.In addition, the use of various alkali metals was used to study the effect of the ionic radius and mobility on the local change in the structure in the focal region of laser radiation.

NEW COMPOSITE MATERIALS BASED ON NANOPOROUS GLASSES CONTAINING MANGANESE OXIDES

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A method has been developed and new composites containing manganese oxides have been synthesized on the basis of porous glasses. The synthesis was carried out by successive impregnations of porous glass in aqueous solutions of $MnCl_2$ and oxalic acid $H_2C_2O_4$, followed by heat treatment of the samples in an argon atmosphere to decompose the reaction product MnC_2O_4. Composites containing Mn_xO_y were obtained. The chemical composition and phase structure of the composites have been investigated.

STUDY OF THE OPTICAL PROPERTIES OF ANCIENT RUSSIAN GLASSES AND THEIR MODERN ANALOGUES

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Basing on the composition of three blue and violet ancient Russian glasses of XII – XIII centuries a series of glasses in the triple system K_2O-PbO-SiO_2 has been obtained by melt-quenching technique in electrofurnace. The blue color was achieved by the combination of manganese, copper and iron that present in the glass matrix in different oxidation states. The CIE LAB color coordinates of the glasses are compared with the lead glass colored by cobalt ions.

STUDY OF THERMAL STABILITY OF MANGANESE-BEARING ALUMINOPHOSPHATE GLASS UNDER CONDITIONS OF SLOW AND QUICK COOLING

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Thermal stability of manganese-bearing glass was investigated under conditions of slow and quick cooling. It has been established that at quick cooling the glass demonstrates insignificant degradation of qualitative characteristics. At slow cooling the glass has a strong tendency to crystallization and dissolution. Thisnegativeeffectis unacceptable at radionuclide immobilization and can be eliminated by using modifying agents.

LUMINESCENT NANOPARTICLES IN SILICATE GLASS

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Typical size of nanoparticles, which are quantum dots, varies in the range between 1 and 20 nm depending on type of substance. Quantum dots synthesized in silicate glass absorb electromagnetic waves in a broad range of length and radiate in a narrow range what makes them as useful light source. This circumstance is important for utilizing the luminescence nanoparticles inside silicate glass as working materials for laser, solar elements and light diodes.

COLLOID-CHEMICAL PROPERTIES OF HIGH-SILICA MACROPOROUS GLASSES IN SOLUTIONS OF SODIUM AND IRON (III) CHLORIDES

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The electrokinetic properties of macroporous glass membranes and particles in sodium and iron (III) chlorides solutions were investigated. The dependence of porous glass electrokinetic properties on concentration of NaCl solutions is predicted by the theory. Specific sorption of multi-charged ion leads to the appearance of an extremal dependence of the efficiency coefficient on the ionic strength and the region of positive zeta-potential due to super-equivalent adsorption in the Stern layer.

HIGHLY REFRACTIVE GLASSES BASED ON LANTHANUM NIOBIUM BORATE SYSTEM

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Highly refractive glasses in the system La_2O_3–Nb_2O_5–B_2O_3 were synthesized. In the glass-forming region glasses were homogeneous and have refractive indices up to 1,99. The most perspective compositions were modified by TiO_2 and ZrO_2. As a result, it was possible to synthesize a number of glasses with refractive indices up to 2,1 and optimal glass-forming ability. The resulting compositions are promising for the further development of glasses with high refractive indices.

ARCHAEOMETRIC INVESTIGATIONS OF GLASS OF THE EARLY – MID-1ST MILLENIUM AD FROM EASTERN EUROPE: METHODS AND RESULTS

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We present an overview of our investigations of ancient glass composition and origin, conducted since 2016. Samples originated from various archaeological sites of Eastern Europe have been studied by SEM-EDS, EPMA and LA-ICP-MS methods. The results imply that the glass has been produced in Egyptian and Levantine glassmaking centres, supplying raw glass to Roman Europe. Here, at the very periphery of the Roman world, the recycling practices were especially widespread.

MANIPULATION OF THE PHYSICAL PROPERTIES IN SODIUM BOROSILICATE GLASSES MODIFIED WITH TRANSITION METALS OXIDES

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Effect of the iron and nickel oxides on the structure and properties of sodium borosilicate glasses has been investigated. The structure of the glasses was determined by TEM/SEM, XRD, XPS, Mössbauer and Raman spectroscopy. The Dynamic Impedance Spectroscopy in wide temperature and frequency range was used to determine the dielectric properties and electrical conductivity of the glasses. Magnetic properties were discussed taking into account structural changes owing to transition metal oxides.

THERMODYNAMIC SIMULATION AS AN ALTERNATIVE TO THE EXPERIMENT: A STUDY OF THE INTERACTION OF GLASS SEALANTS WITH SOFC FUNCTIONAL MATERIALS

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Thermodynamic approach is proposed for simulation of reaction products on the interface of glass sealant and functional materials of proton-conducting fuel cells (PCFE). It is applied to simulate the interaction between glasses and PCFE materials, and some drawbacks are found namely, the lack of thermodynamic data, adequate interpretation of the simulation results, etc. Nevertheless, when developed, this approach will be extremely useful for the prediction of interactions.

VISCOSITY OF SODIUM BORON MELTS

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Viscosity is one of the most important physical and chemical property of melts. It depends on the structure and the boron oxide network order. In the present work we have measured the viscosity from alkali oxide (Na_2O) content. It was discovered by vibrational method in temperature range: 900-1600 K.

FORMATION OF ZNO-AG NANOCOMPOSITES BASED ON POROUS GLASS AND RESEARCH OF THEIR ADSORPTION PROPERTIES

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The results of studying the ability of porous matrices modified with zinc oxide and silver nanoparticles to adsorb organic dyes from aqueous solutions are presented. It is shown, that this modification increases the sorption capacity of porous glass. The study of isotherms of adsorption of dyes on the surface of porous glass and composites based on it has been carried out. The processes of adsorption of CSB molecules and their dimerization in concentrated solutions are competing.

FLUORINE CONTAINING STRONZIUM ALUMINUM SILICATE GLASSES FOR GLASS IONOMER CEMENT

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Glass ionomer cement is a perspective material for dental filling application. The domestic production problem is investigating and organizing technological process. During research work a SiO_2(30÷42), Al_2O_3(16÷22), P_2O_5(6÷8), SrO(19÷21), AlF_3(11÷13) glass composition with a certain Al_2O_3/SiO_2 ratio was developed. The obtained glasses properties as refractive index, transparency, mechanical characteristics, fluorine content, TCLE were analyzed. Also the process of glass synthesis was optimized.

PRECIPITATION OF SILVER NANOPARTICLES IN THE VOLUME OF PHOSPHATE GLASS UNDER THE LASER IRRADIATION

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We studied the dependence of the microstructure of laser-inscribed waveguides in the silver-doped phosphate glass on the laser exposure parameters and showed that by tuning the latter, it is possible to induce various types of microstructure modification and to write waveguides with different optical properties. The waveguiding properties were studied and it was showed the supercontinuum generation process in the written waveguides corresponded to the silver nanoparticles formation.

PHENOMENON OF THE PLASMON RESONANCE BAND POSITION CHANGE OF GOLD NANOPARTICLES DURING THE PHASE-SEPARATION PROCESS IN TITANIUM-CONTAINING GLASS

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The maximal red-shift of the LSPR band as high as 100 nm was achieved for ZnO-MgO-Al_2O_3-SiO_2 glass nucleated with TiO_2 which is characterized by the presence of 10 nm phase-separated regions and 3-5 nm precipitated gold nanoparticles. The fitting of the absorption spectra showed that the distinct red-shift of the LSPR band is caused by the increased refractive index of the surrounding medium (in the interval 1.6–2.6).

SYNTHESIS AND OPTICAL PROPERTIES OF QUARTZ GLASSES DOPED WITH CERIUM AND TITANIUM

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This paper discusses methods for obtaining of quartz glass from high-purity quartzites of the Bural-Sardyk deposit and its optical characteristics are given for various types of doping.
Activation of silica glass with titanium and cerium gives almost complete absorption of samples in the UV region starting from 230 nm. The dopant concentrations were selected to achieve UV absorption from 230 nm while maintaining the optical homogeneity of the silica glass.

INTENSIFICATION OF DEALKALIZATION PROCESS OF SILICATE GLASSES WITH ACID GASES

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To intensify the process of dealkalization of silicate glasses with acid gases the following ways have been used: optimization of regimes of thermochemical treatment, determination of the most efficient gaseous reagents in the process of dealkalization of glass from the thermodynamic position, the thermochemical treatment of glass with gaseous reagents under the influence of electric and magnetic fields.

COMPOSITION OF REACTION PRODUCTS OF SILICATE GLASSES WITH ACID GASES

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The present work deals with the technique used to analyze the products of chemical reaction of silicate glasses with acid gases. Glass samples have been subjected to thermochemical treatment with gaseous reagents in laboratory and industrial conditions. The advantages and disadvantages of different methods used to analyze products of dealkalizition are compared.

ELABORATION OF THE PROCEDURE FOR MELTING BOROSILICATE GLASSES WITH SIMULATED HLW COMPONENTS AND STUDY OF CHEMICAL STABILITY OF SUCH GLASSES

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This paper examines compositions of borosilicate glasses containing HLW components as well as temperatures of their melting and molten glass discharge. Using the method of long-term leaching, chemical stability of the examined compositions was estimated by analyzing leaching rates of cesium analogues (i.e. lithium, sodium and potassium). Leaching of matrix components (silicon and boron) and HLW components (aluminium) was also studied to monitor the behavior of multivalent elements.

PHASE TRANSFORMATIONS IN GLASS OF THE K_2O-ZnO-AL_2O_3-SiO_2 SYSTEM DEVELOPED FOR GLASS-CERAMIC FORMATION

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Glass was prepared by the melt-quenching technique with stirring at 1580 °C. The structure of the initial glass and its transformation with the heat-treatments was studied by X-ray diffraction analysis and differential thermal analysis. Melting points in a four-component system were estimated using two new independent semi-empirical methods. The experimentally obtained melting temperatures of the precipitated crystalline phases were compared with temperatures found using semi-empirical methods.

SPECIALLY PURE CHALCOGENIDE GLASSES AND FIBERS FOR NOVEL FUNCTIONAL DEVICES OF MIDDLE INFRARED FIBER AND NONLINEAR OPTICS

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Novel chalcogenide glass compositions and methods for their preparation in high purity state have been developed. Low-loss multimode, single-mode and microstructured optical chalcogenide fibers were fabricated. Chalcogenide fibers doped with rare earth ions have demonstrated photoluminescence and laser action in the mid-IR range. The fibers were tested for creating novel mid-IR photonic devices, such fiber sensors, luminescent radiation sources, lasers, and supercontinuum generators.

NEW FUNCTIONAL GLASS-BASED MATERIALS

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New glass-based materials and new approaches to the functionalization of glasses and glass ceramics by micro - and nanomodification of their structure by femtosecond laser beam, developed at the Department of Glass and Crystals of the Mendeleev University of Chemical Technology, are discussed.

UVIOL GLASS FOR SOURCES OF ULTRAVIOLET RADIATION: COMPOSITIONS, PROPERTIES, TECHNOLOGY

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The influence of the raw materials purityand the cullet on *the UV-transmission* and *solarization* of glass was determined. Raw materials for the preparation of the charge, as well as refractories for the laying of glass-making furnaceelements were selected. The design of the glass-melting furnace has been developed, the method and equipment for molding thin-walled glass tubes have been selected. Glass melting and machine production of tubes for bactericidal and erythema lamps have been mastered.

SYNTHESIS OF GLASSES IN THE Na_2O-BaO-B_2O_3 SYSTEM AND STUDY OF THEIR PHYSICO-CHEMICAL PROPERTIES

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In this work 41 glasses of the NaBaB system were synthesized. The physicochemical properties of the samples were investigated, such as density, microhardness and refractive index. The studied properties linearly depend on the composition.

GLASS CRYSTAL PROPPANTS BASED ON THE WASTE OF METALLURGICAL PRODUCTION

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Theses of the article are devoted to research on the receipt of lightweigglass-ceramic proppants from the blast metal slag. The impact of the parameters of thermal treatment of slag particles on their shape, the formation of pores and partial crystallization are considered.

SOME GLASS APPLICATIONS, WAITING FOR RESEARCHERS (BASED ON OPEN PUBLICATIONS)

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The analysis of published reports on the trends of inorganic glass research in the 21st century has been carried out. It is noted that the Institute has lost some important areas of experimental work and gives examples of topics promising to continue. It is concluded that new applications of glass-like materials are developing both in traditional applications and in new information technologies.

CHEMICAL COMPOSITION OF RUS'IAN GLASS: TRADITIONAL AND "NEW" METHODS

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The lecture deals with a comparative study of the chemical composition analyses of glass found on the territory of Rus'. The analyses have been conducted by both traditional (optical emission spectroscopy) and "new" methods (scanning electron microscopy with energy-dispersive X-ray spectral analysis, etc.). The "old" method was used to ensure consistency with the wealth of previous results accumulated through the years and because of its affordability in light of the current situation in Russia.

ACID-BASE CONCEPT OF VAPORIZATION OF OXIDE GLASS-FORMING SYSTEMS

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The general regularities of vaporization of oxide glass-forming systems are considered and summarized. Vaporization processes including content of the gaseous phase over phosphate, borate, germanate and silicate binary and multicomponent systems studied by high-temperature mass spectrometric method are discussed. The main physicochemical factors for the prediction of vaporization processes and the content of vapor over oxide glass-forming systems are illustrated and suggested.

ARTISTIC GLASS AND CERAMICS: NEW COLOR OPTIONS

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The work introduces readers to the information published in open sources about the experience of researchers of colored glass and ceramics, as well as new compositions of colored glasses. Its relevance is due to the sharply reduced number of textbooks on the subject of art glass and ceramics and the rapidly disappearing sources of the past years on paper.

55 YEARS OF THE GLASS CRYSTALLIZATION GROUP OF THE INSTITUTE OF SILICATE CHEMISTRY

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The results of the work of the glass crystallization group, organized in 1966, are presented. The parameters of crystal nucleation in glasses were obtained for 47 compositions. These are 32

compositions of glasses of lithium and sodium silicate systems and 15 compositions of glasses of other systems. The possibility of quantitative description of crystal nucleation makes it possible to significantly optimize the production processes based on glass.

SYNTHESIS AND PHYSICO-CHEMICAL PROPERTIES OF TELLURITE GLASSES CONTAINING SODIUM HEXAMETAPHOSPHATE

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The use of sodium hexametaphosphate as an effective glass-forming agent for tellurite glasses is proposed. For the glasses of the compositions $TeO_2 – Na_6P_6O_{18}$, $TeO_2 – WO_3 – Na_6P_6O_{18}$, $TeO_2 – MoO_3 – Na_6P_6O_{18}$, $TeO_2 – ZnO – Na_6P_6O_{18}$, the regions of glass formation were determined, the thermal behavior was studied, the thermodynamic characteristics of the devitrification and the glassy state were determined, and the optical transparency in the UV, visible and IR spectral regions was studied.

MULTILAYER MAGNETIC SCREENS USING METALLIC GLASSES

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The article discusses two ways to reduce the weight of ferromagnetic screens: multi-layer cylindrical structures with insulating gaps and screens made of more advanced magnetically soft materials with increased saturation induction.
Multilayer screens become most effective with an increase in $\mu>100$. This can be demonstrated on the example of the limiting case - replacement of one screen of great thickness by five almost infinitely thin screens.

EFFECT OF ALKALINE-EARTH OXIDES (MgO, SrO, BaO) ON PHYSICAL-CHEMICAL PROPERTIES OF CALCIUM BOROSILICATE GLASS

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The present study investigates the influence of MgO, SrO, BaO on physical-chemical properties, such as: density, Vickers microhardness, Young's module of elasticity, thermal behavior, biologically active properties, apatite-forming ability of melt-quenched calcium borosilicate glasses with the composition: 1 - $Na_2O–SiO_2–CaO–B_2O_3 –P_2O_5 – CaF_2$; 2 - $K_2O–SiO_2–(x-y)CaO–B_2O_3–P_2O_5–CaF_2–y$ MO (where MO – MgO, SrO, BaO).

BIOACTIVE POROUS GLASSES

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The paper presents the results of a study of the biological activity of porous glasses (PG) and composites obtained on the basis of PG. PG NPF with the composition (wt%) $0.17Na_2O{\cdot}5.96B_2O_3{\cdot}93.75SiO_2{\cdot}0.07P_2O_5{\cdot}0.05F$ and PG 8B with the composition $0.2Na_2O{\cdot}4.2B_2O_3{\cdot}95.5SiO_2{\cdot}0.1Al_2O_3$, and composites obtained on the basis of PG modified with silicon molybdenum heteropolyanion were used. The material has demonstrated a high biological activity in relation to the selected microorganisms.

THE INFLUENCE OF METALLOPHILLIC INTERACTIONS ON THE PROPERTIES OF CHALCOGENIDE GLASSES

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Abnormal ductility of crystalline silver chalcogenides have been explained by the coexistence in them of the directed covalent bonds silver-chalcogen and undirected metallophillic bonds silver-silver. Based on this, it is proposed to introduce in chalcogenide glasses composition of a silver chalcogenides to increase their ductility without lowering the glass transition temperature. Experimental results of the study of some glass-forming systems confirming the validity of this concept are given.

THE DEVELOPMENT OF THE RUSSIAN THEORY OF GLASS STRUCTURE (SELEBRATING THE 100TH ANNIVERSARY OF THE CRYSTALLITE THEORY)

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This paper considers the crystallite theory, its evolution, a comparison with the random network theory, its significance for the development of structural models and for the understanding of the structure-property relationships. Examples are given of calculations performed with the use of different theoretical approaches developed in Russia and the West.

STRUCTURAL AND ACID-BASE PROPERTIES OF COMPOSITE MATERIALS BASED ON ALUMINUM AND SILICON OXIDES-HYDROXIDES OBTAINED BY ACID PROCESSING OF NEPHELINE

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The results of studies on the properties of aluminum-silicon composite compounds obtained from sulfuric acid solutions of the decomposition of nepheline and proposed for use in the production of functional glasses are presented. Their structural and surface properties are determined and the distribution of the specific surface charge of the samples is studied. This parameter was found to correlate well with the H_2SO_4 concentration used for the decomposition of nepheline.

LASER WRITING OF LUMINESCENT DOMAINS IN SILICATE AND PHOSPHATE GLASSES DOPED WITH SILVER OR CADMIUM SULFIDE

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In this work, photoluminescent domains were laser-written in silicate or phosphate glasses doped with silver or cadmium sulfide. Maxima of photoluminescence signal were registered at 675 and 600 nm for cadmium sulfide doped silicate and phosphate glasses, respectively, and at 685 and 600 nm in silver doped silicate and phosphate glasses, respectively, under 488 nm excitation by an argon laser beam. The obtained data can be used in the development of new glass-based materials for optical memory.

VAPORIZATION AND THERMODYNAMIC PROPERTIES OF THE MELTS OF THE TiO_2-Al_2O_3 SYSTEM

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Using the Knudsen effusion mass spectrometric method, vaporization processes and thermodynamic properties of the melts of the TiO_2-Al_2O_3 system were studied in the temperature range 2345-2500 K. The vapor composition over the melts under investigation corresponded to that over pure titanium and aluminium oxides. The component activities and excess Gibbs energies determined in the TiO_2-Al_2O_3 system for the first time evidenced insignificant negative deviations from the ideal behavior at 2345 K.

TWO-STEP SYNTHESIS OF NIOBIUM DOPED NA–CA–(MG)–P–SI–O-(N) GLASSES AND GLASS-CERAMICS. THE ANALYSIS OF STRUCTURE, THERMAL AND BIODEGRADATION PROPERTIES

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Untraditional two-step synthesis was used to prepare Na-Ca-(Mg)-P-Si-O-(N) glasses and glass-ceramics. High content of niobium dissolved from the crucible into glass network. Nitrogen was incorporated into the Na-Ca-P-O glass system. Glasses contain non-apatitic or amorphous calcium phosphates. Glass-ceramics contain nanocrystallites made from phosphates. Materials exhibit improved T_g and thermal stability. The *in vitro* dissolution test confirms that the glasses have biosolubility properties.

PHASE EQUILIBRIA IN THE Al_2O_3-SiO_2-ZrO_2 SYSTEM: CALCULATION AND EXPERIMENT

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The phase diagram of the Al_2O_3-SiO_2-ZrO_2 system was calculated in the temperature range 400.15-2550.15 K using the Nuclea database and the Gibbs energy minimizer (Gemini2). Phase equilibria with the participation of polymorphic modifications were observed in this system. Also, the coordinates of two triple eutectic points were found in the system.

MODIFICATION OF MgO-Al_2O_3-TiO_2-SiO_2 GLASS USING THE SILVER DIFFUSION FOR FORMATION OF THE LUMINESCENT MOLECULAR CLUSTERS

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Sitall-forming glass, mol%: SiO_2-53.1; Al_2O_3-17.7; MgO-17.7; TiO_2-8.8; F-2.6; As_2O_5-0.1. was investigated. Diffusion processing of glass was carried out at a temperature of 600 °C for 130

minutes in KNO_3 (99.5 mol%) - $AgNO_3$ (0.5 mol%) melt or by diffusion from a composite paste containing KNO_3, $AgNO_3$ and Al_2O_3.
As a result of diffusion treatment, an increase in the absorption of glass in the UV region of the spectrum is observed.

RELAXATION OF THE GLASS STRUCTURE BELOW THE GLASS TRANSITION TEMPERATURE ACCORDING TO DENSITY MEASUREMENTS

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The structure relaxation of three oxide glasses was studied below the glass transition temperature by monitoring of density evolution. It was shown that the density of the stabilized glasses increases first linearly with a decrease in temperature, then deviates from the linear dependence towards lower values. For the stabilized sodium borate glass, the change in density was ceased at temperature below the glass transition temperature by 48°C.

CRYSTAL GROWTH RATES ON THE SURFACE AND IN THE VOLUME OF SODA -LIME – SILICA GLASSES

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The growth rate of crystals on the polished surface of soda-lime-silica glass is an order of magnitude higher than the growth rate in the volume at temperatures slightly above the glass transition temperature. As the temperature increases, the rates gradually converge. At low temperatures, the effective diffusion coefficient of the structural units along the glass surface is significantly higher than that in the bulk of glass, and gradually approaches the latter with increasing temperature.

QUARTZITES OF THE EASTERN SAYAN ARE NATURAL MINERAL RAW MATERIALS FOR HIGH-TECH QUARTZ GLASS

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Geochemical characteristics of natural mineral quartz raw materials predetermine the area of its industrial application. High-purity monomineral quartzites of the Eastern Sayan have been investigated in this work. The modes and stages of obtaining quartz concentrate for each type of quartzite have been developed, taking into account their geochemical characteristics. Using the example of superquartzites, the efficiency of plasma treatment for the removal of Na has been studied.

SPECIAL ASPECTS OF CONTACT ZONE OF FUSED SILICA DETAILS BONDED BY DIFFERENT WAYS

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In this paper, laser welding and sol-gel technology considered as methods for connection quartz parts. The aim of this work is to research of the contact zone and the thickness of the SiO2 layer after connection the quartz rods and plates. The analysis performed by scanning electron microscopy. It shown that the technology of connection quartz parts through an intermediate layer of silicon dioxide has a number of advantages over the technology of laser welding.

POSSIBILITY OF USE OF YTTRIUM-ALUMINUM GLASSES AS ACTIVE OPTICAL MEDIA

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This paper presents the data of long-term studies of the spectral-luminescent properties of REE ions in glasses of the Ln_2O_3-Y_2O_3-Al_2O_3-B_2O_3 system (Ln = Ce, Tb, Yb). It is shown that these glasses are promising for the creation of a UV visualizer and two-coordinate X-ray detector with a high spatial resolution (Ce, Tb), as well as for the development of compositions of highly doped glasses for active laser elements (Yb).

AUTHOR INDEX