Insights in Mining Science & Techonology
ISSN: 2689-4629
Research Article
Volume 2 Issue 1 - March 2020
DOI: 10.19080/IMST.2020.02.555577

Juniper Publishers
key to the Researchers
Insights Min Sci technol

Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals

Anatoly V Manankov[1,2]*

[1]*Department of Geological Sciences, Tomsk State University of Architecture and Building, Russia*

[2]*Department of Geological Sciences, Tomsk National Research State University, Russia*

Submission: January 15, 2020; **Published:** March 09, 2020

***Corresponding author**: Anatoly V Manankov, Department of Geological Sciences, Tomsk State University of Architecture and Building, Russia

Abstract

The relevance of research is due to the efficiency of development of minerals in the Arctic, which is largely determined by the transport and production infrastructure. The severe natural and climatic conditions of the Far North with the predominance of permafrost (MMP) significantly affect the economy and ecology of the territory, for which the cost of building materials and structures now amounts to 70% of the cost of oil and gas. The development of Yamal, access to the shelves of the Arctic seas requires the creation of innovative breakthrough technologies for oil and gas production, including the construction of artificial islands and underwater structures on the shelf. But such technologies are not possible without modern building materials and structures that have many times greater strength, durability, wear resistance, acid resistance and other functional parameters of the widest range for industrial, transport and civil construction.

The aim of the research was to develop multifunctional glass-crystalline materials of metasilicate composition (sikam class) based on local natural raw materials of the Polar Urals with an unusual combination of high physical, mechanical and chemical properties. Creation and implementation of new technologies for the construction of transport and industrial and trade infrastructure (roads, railways, airfields, berths, etc.) based on these materials in special conditions: in the permafrost and wetlands of the North, Siberia and the Far East.

Objects of research: dump magmatic rocks of the basite series and metamorphites of gold deposits of the Polar Urals.

Keywords: Petrositalls; Coherence of metasilicates; Sikam; Metastable phase separation; Homogeneous-heterogeneous mechanism of growth of nanocrystals; Resource efficient technologies; Pile-trestle road structure; Transport

Introduction

The bowels of the Russian North and the Arctic shelf store 9/10 natural gas reserves, about 2/3 of the oil reserves, almost all apatite ores, gold, diamonds, including the unique impact heavy diamonds Papigaya astroblems, platinoids and rare earth metals, tin, anthracite Taimyr. The development of mineral resources takes place in conditions of total impassability, and therefore requires high costs for the creation of transport and production and civil infrastructure. Arrangement of the Northern Sea Route, creation of its land backup - the Northern latitudinal route from Salekhard to Igarka-Khatanga - Tiksi, including construction of dams as bridge passages of the Iharsky hydroelectric power station (HPS)and the Nizhne-Lena HPS. Creation of an Arctic rocky military transport infrastructure that will ensure strategic balance by using the shortest approach distance from mobile missile trains to the enemy through the North Pole.

Extremely severe natural and climatic conditions of Siberia and the Arctic require the use of high-strength and highly efficient building structures of the widest range for industrial, transportation and civil construction (Figure 1). The need for such high-strength construction structures is urgently needed and their expensive delivery from the “mainland”, in turn, requires the organization of their production at the site of use and from local raw materials and cheap local energy carriers, to significantly reduce their prime cost.

The urgency of creating SCS and structures based on them is dictated by the expansion of the scales of the development of the Far North, access to the shelves of the Arctic seas, the impossibility of using traditional offshore drilling platforms. Therefore, the authors propose to replace the traditional steel reinforced concrete structures with a new material - petrositalls-sikam class, which fully meets the special conditions of the Arctic and with the possibility of its production from local raw materials.

Methods of Research

Theoretical and experimental studies of raw materials, calculation of the charge composition for metasilicate seedlings - the new class "sikam" (SCS), methods for determining the main technological parameters, methods for studying the basic properties of products, methods for creating new innovative building structures, methods for studying technical and economic indicators.

Historical Reference

Sitalls - new constructive materials appeared in the middle of the twentieth century. For missile technology. In connection with the development of science and technology, the sitalls are becoming innovative materials in various fields. There are several classifications of the sitalls: according to the composition of the raw materials (petrositalls, shlakositalls, technical sitalls), in the mineral composition of the sitalls themselves (pyroxene or sikams, spodumene, cordierite, high-silica, lead containing, etc.), according to the properties of the sitalls (wear-resistant, acid-heat-resistant, as well as special absorbing thermal neutrons, etc.) [1-6]. An important property of SCS is a unique combination of chemical, thermal resistance and high resistance to mechanical abrasion. This allows them to be used as an effective material in technological nodes with specific operating conditions. High strength and resistance to abrasion, fire and weather resistance, chemical resistance make this material durable.

The raw material for SCS can be quite different:

a) igneous rocks mainly with a deficit in the composition of silica (ultrabasic, the main intrusive and effusive rocks)

b) metamorphic and sedimentary-metamorphic rocks of the class of silicates and carbonates

c) a variety of silicate-containing industrial waste from the extraction, enrichment and processing of virtually any minerals (ore, nonmetallic, energy coal, etc.) after the extraction of scarce metals from them - from black and non-ferrous to rare elements, lanthanides and actinides. According to our calculations, in the first approximation, such a strategy for the use of mineral resources will reduce by 25% the extraction of primary minerals [7].

In the Tomsk Scientific School of Mineralogy, under the guidance of Professor AV Manankov, a new class of multifunctional glass-crystall materials of the sikam class and their production technologies was created by the staff of three universities (NI TSU, NI TPU and TGASU), based on the results of fundamental research in the field of physical geochemistry (trade mark 92355) on the basis of non-deficient natural raw materials and industrial wastes. The appearance of these materials has proved to be in demand by many industries and new technology. It is important to emphasize that it has become possible to develop (research and development) new low-cost and highly efficient technologies to produce new structures with particularly high strength and reliability in the extreme natural conditions of the Arctic.

The study of the rocks of the gold ore deposits of the Polar Urals in accordance with the Ural Polar - Ural Industrial Program, launched in 2011, New Year-Monte, Petropavlovsk and Amphibolitic showed that these rocks of the basic composition, according to the petrographic and mineralogical-geochemical composition, meet the quality and volume requirements for the production of petrositall road and building constructions [8-11]. To produce foamed petrositall - penosikam, a highly effective thermal insulation wall material, local loam and silty sands, common in the valleys of the great Siberian river Ob and its numerous tributaries throughout the West Siberian lowland, are suitable as feedstock [12]. The very production of new building materials and structures with particularly high strength is provided by the automated technology developed by the authors of controlled synthesis of the fractal spherulite structure of petrositall-SCS. Automation of controlled synthesis of petrositall is in the development of a crystallochemical formula for calculating the composition of the charge on a monomineral mineral metasilicate composition from the position of the revealed limits of isomorphism [7]. The objects of investigation are polymorphic modifications of chain metasilicates formed in the nonequilibrium conditions of the crystallization attractor-bifurcation points.

Initial Rocks and Calculation of Charge Composition for SCS

The availability of local natural raw materials significantly reduces the cost of production. This is since the raw material in the specific weight of the cost of the production of petrourgical products occupies not less than 48% [5,13,14]. At the same time, when building, for example, oil and gas fields and building roads in permafrost conditions, the most expensive part of their cost falls on building materials. For one kilometer of the road of the III category, the cost of materials is 45 million rubles [8].

Table 1 presents the chemical compositions of the initial rocks of the Polar Uralaz of three deposits. The authors performed mineralogical-petrographic, geochemical and experimental studies of these rocks in order to obtain petrochemicals of the SCS class from them. The results of chemical analyze are the basis for the theoretical design of raw materials to produce sitan by the formula "acidity modulus SCS" [15,16]. For minerals of the pyroxene group, calculations are made for 6 oxygen atoms, considering the limits of isomorphous substitutions in the three sublattices of pyroxenes M2, M1 and R [17]. The monomineral metasilicates obtained with an extensive field of isomorphous substitutions are the most promising, since coherent nanostructures arise in the glass structure [18-23], which are energetically related to each other by harmonic ratios (Table 2).

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

Table 1: The Chemical Composition of the Basalts of the Polar Urals.

Oxides	1	2	3	4
SiO_2	48,67	45,08	62,30	57,66
TiO_2	0,37	0,59	1,05	0,79
Al_2O_3	16,93	14,85	11,98	15,14
Fe_2O_3	5,01	8,54	3,73	2,82
FeO	6,34	7,69	5,51	4,27
MgO+MnO	5,80	7,73	3,05	3,36
CaO	11,84	9,95	5,96	5,11
Na_2O	2,00	1,40	1,43	2,93
K_2O	0,12	0,17	2,33	2,20
P_2O_5	0,02	0,07	0,12	0,31
H_2O	0,28	0,30	0,17	0,38
P	2,31	2,74	1,26	4,21
Sum	99,69	99,11	98,89	99,18

Table 2: Crystallochemical for Mulas of Petrositalls.

Sample No.	Sublattices in the Pyroxene Formula	
	M1	R
1	$(Ca_{0'06}Mg_{0,.29}\cdot Fe^{+2}_{0,18}\cdot Fe^{+3}_{0,13}\cdot Al_{0,34})$	$(Si_{1'65}\cdot Ti_{0,01}\cdot Al_{0,34})\ O_6$
2	$Mg_{0,4}\cdot Fe^{+2}_{0,22}\cdot Fe^{+3}_{0,22}\cdot Al_{0,20})$	$(Si_{1,57}\cdot Ti_{0,02}\cdot Al_{0,41})\ O_6$
3	$(Ca_{0,4}Mg_{0,13}Fe^{+2}_{0,13}\cdot Fe^{+3}_{0,08}Al_{0,25})$	$(Si_{1,81}Ti^{0,02}\ Al_{0,16})\ O_6$
4	$(Ca_{0,29}Mg_{0,16}Fe^{+2}_{0.11}\cdot Fe^{+3}_{0.07}Al_{0.38})$	$(Si_{1,79}Ti_{0,02}\ Al_{0,18}\ P_{0,01})\ O_6$

Experimental Studies of The Melting Conditions of Charges and the Saturation of Homogeneous Glasses

In accordance with the calculations, the initial charge was prepared. As the nucleators of crystallization of the main silicate phases, chromium oxide, which is traditional for pyroxene sitales, was used. Melting was carried out in alundum crucibles in a silicate furnace. Optimum technological parameters: melting point (1360 -1400) °C, melting time: 1.5-2.0 hours. After hardening and annealing, homogeneous glasses were studied using various physicochemical methods to determine the technological parameters of the saturation. Glass samples to determine the temperature intervals for nucleation and growth of crystals were investigated using a differential thermal method (DTA) on the NETZSCHSTA 409 PC / PG device in the range of 20-1100 °C in the laboratory of the Center for Analysis of the Center of State Service of TSU. Thermograms with pronounced endoeffects (T1), corresponding to the nucleation temperatures of the main phase, and even more contrasting exoeffects (T2), responsible for crystal growth (Table 3) were obtained.

Table 3: Results of DTA glasses based on the Basilites of the Polar Urals.

Sample Number	T1,°C	E1, mW/mg	T2°C	E2, mW/mg
1	723	0,391	905	0,494
2	711	0,423	897	0,812
3	742	0,321	951	0,591
4	727	0,360	964	0,686

Note: E1 is the activation energy of nucleation, and E2 is the crystal growth energy. (Analyst-Asochakova EM). Numbers 1-4 correspond to the numbers in Table 2.

For each composition, kinetic experiments were carried out to select the temporal technological parameters. The isothermal heating time was varied at stages T1 and T2, as well as the heating rates from T1 to T2. The time of isothermal heating on T1 was varied from 15 minutes to 75 minutes, and at a crystal growth stage from 15 to 60 minutes. From the experiment products, transparent and polished sections were prepared for the study of structural and texture properties (Figure 1). Analysis of the results of the study showed that the optimum time for isothermal heating at stages T1 and T2 should be at least 45 minutes. On polished sections with the help of a PMT-3 microscope the microhardness was determined.

Figure 1: Road Conditions: The Tundra of Yamal in the Summer.

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

Based on the results of the analysis of the physicochemical properties obtained, optimal synthesis conditions and technological parameters were determined. Firstly, the crystallized on optimal regimes tiles were of regular geometric shape, homogeneous texture and color, and without visible deformation. Second, the nanostructure microscopically homogeneous, the average crystal size of 5-8 microns, no "porphyric" formation. Using the optimum temperature and time parameters, plates of the following sizes (in mm) were obtained: 100x50x8, 150x150x15. Of these, samples were prepared for the study of microstructure, physico-chemical properties, and samples for X-ray phase analysis (Figure 2).

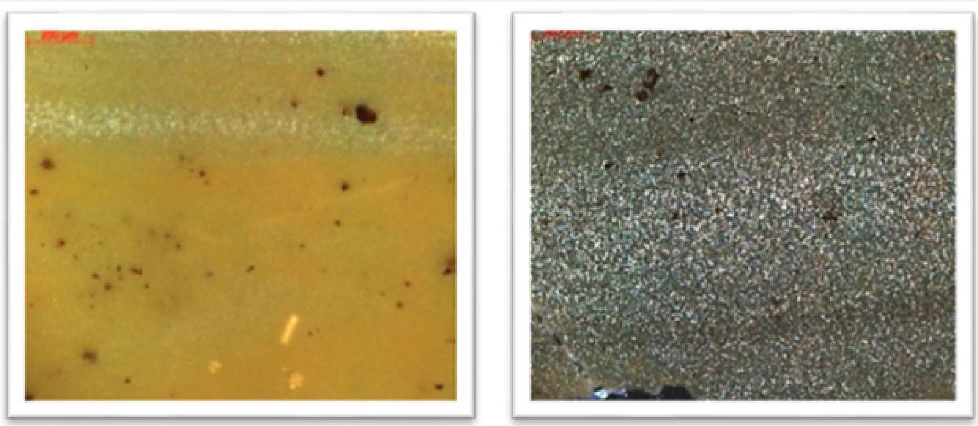

Figure 2: Influence of The Time of Isothermal Heating at Stages T1 And T2 on the Degree of Crystallization.

Left - 15 minutes, right - 50 minutes.

Mineral Composition, Structures, Textures and Physicochemical Properties of Petrochemicals of the CKS Class

The results of the X-ray phase analysis (XRD) were compared with the ASTM tabulated data (Crystallographica Search-Match). The confirmations of the optimality of the initial compositions and technological parameters are obtained. It has been established that the synthesized petrositalls correspond to the class of sikams, since they have a monomineral metasilicate composition. According to the results of XRD, they correspond either to a solid solution of the composition, monoclinic pyroxenes-β-wollastonite with submicrocrystalline structures (Figure 3), or pure diopside ($CaMgSi_2O_6$), or solid solutions of monoclinic pyroxenes of diopside-hedenbergite series (Fig. determines, in the final analysis, their high operational properties (Table 4).

According to the physicochemical properties of the obtained petrositalles can find wide application in new technology, in various spheres of production processes of oil and gas and other industries. First, a unique combination of high wear resistance and chemical resistance makes them effective as a lining material for various pipelines, chute trays, troughs, and the like.

Table 4: The Main Properties of Synthesized Petrositall Class "Sikam", Stone Casting and other Construction Materials.

Indicator (property)	Petrositallclass "sikam"	Stonecasting*	Concrete*	Castiron*
Indicator (property) Coefficient of linear expansion (CTE)107 °C-1	65-114	48- 100	100	100
Softeningtemperature,°C	950-1100	900-1050	-	-
Abrasionresistance, g / cm²	0,015-0,04	0,02-0,08	-	-
Strength limit, MPA: with static bending	100-188	47-80	-	280
Strength limit, MPA: at compression	707-909	250-500	May-60	800-1000
Chem. resistance, %:				
H_2SO_4	94,6-99,9	99,8	-	-
NaOH	98,0-99,0	98,5	-	-
The cost of 1 cubic meter of Materialsinrubles	9000 At the Petrosital Plant in the village of Kharp, YaNAO	30 000	9000- 24 000 in YaNAO	112 000

Note: * - according [2].

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

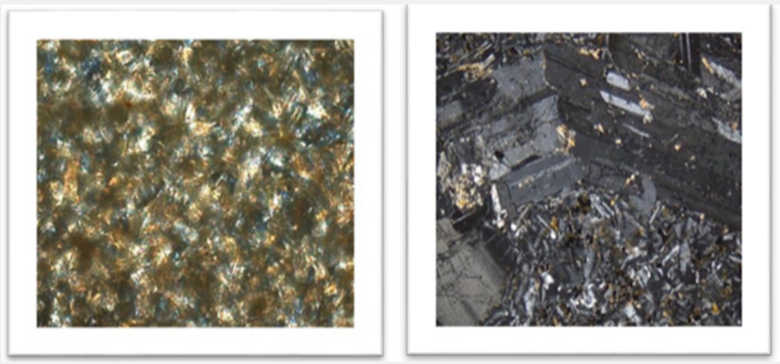

Figure 3: Spherolite Submicrostructure of the Sitall, Obtained at Optimal Technological Parameters (Left) In Comparison with the Original Rock: Porphyry Structure with Inclusions of Plagioclase in the Microallotriomorphic Mass Of Gabbro-Porphyrite (Right. Left - 15 minutes, right - 50 minutes.

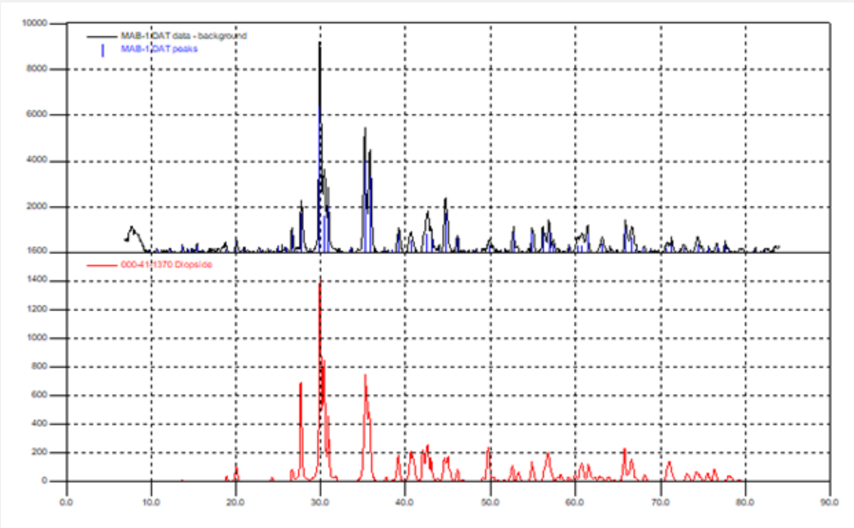

Figure 4: X-Ray Picture of Petrositall from Sample No. 1 (top) and Reference diopside No. 000-41-1370 (bottom).

Knowledge of the mechanisms and kinetics of the crystallization process also plays an important role in the management of the technological process [24-27]. This is explained by the appearance of a new experimental material, which is not always consistent with traditional concepts, and sometimes does not find any explanation at all. This situation arises when describing the high rates of diffusion and growth of crystals (Figure 5).

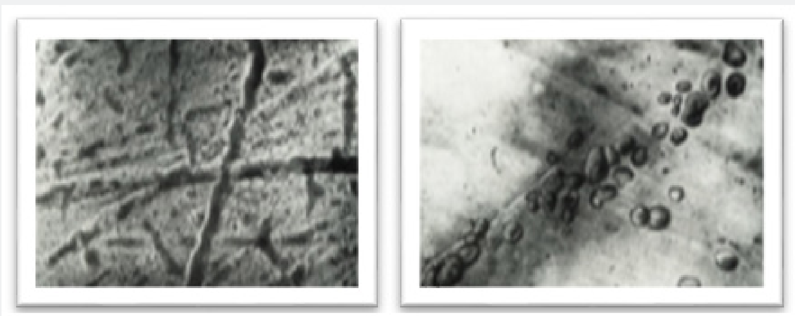

Figure 5: Submicrostructures Of Metastable Decay at the Stage of Homogeneous Nucleation in SCS.

The results of experimental studies of phase transformations in the "glass-sitall" system allowed us to reveal the mechanism of metastable phase separation at the nucleation stage, and at the crystal growth stage homogeneous (Figure 5) and

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

heterogeneous (Figure 6) nucleation mechanisms. These facts fit well into the concept of structural dynamics, based on the most general laws of natural science - the theory of oscillations and waves, which has been invariant in all stages from classical mechanics to supermodern ideas of the 21st century [23]. The wave representations developed by us include interference effects (a holographic model) applied to any level of organization of matter. The holographic model makes it possible to explain and predict the formation processes of ordered structures including nanostructures, the resonance character of energy and mass, and a number of other phenomena [7,28].The advantage of this model is that it makes it possible to logically explain the increase in the rate of crystallization of the developed SCS by orders of magnitude in comparison with the known sitalls.

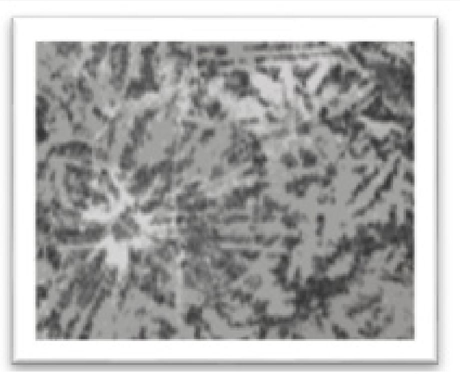

Figure 6: Submicrostructures of Heterogeneous Nucleation Metasilicates on Chromite in SCS.

Economic Aspects of The Project

The obtained scientific results and performed research on the development of the technology for the production of metasilicate stainless steel from local raw materials of the Yamal-Nenets Autonomous Okrug provide a basis for moving to a first approximation to the economic aspects related to the design of the experimental production of petrositall articles (curbs, rings, pavement, facing tiles, bearings, medical implants, etc.) and the development of composite steel-concrete structures (beams, columns, bolts, slabs, spherical and cylindrical tubes, as well as many others GIH designs). A special class will be made of steel-petrositall structures of ultrahigh impact strength with a dispersed fibro-reinforced structure. Let's consider the basic applied engineering and technological solutions and the functional-cost efficiency of production of building steel-petrositall structures of various topologies (flat, cylindrical and spherical) for the installation of linear and production facilities:

Let us consider in more detail the applied engineering and technological solutions and the functional and cost effectiveness of the production of construction steel-petrositall structures of various topologies (flat, cylindrical and spherical) for the installation of linear and production facilities:

a) Automated collapsible roads of industrial, military and civilian use in pile-trestle execution, as cheaper and more durable (Figure 3).

b) Railways, including high-speed railways, in innovative ballastless pile-slab execution.

c) Foundations and foundations of industrial and civil buildings and structures on screw cryoses and a system of highly energy-efficient geothermal heating on heat pumps.

d) Enclosing structures of buildings and structures of industrial and civil execution of foam porcelain. (foamed sinter from loam), surpassing brick, foam concrete, sandwich panels and other types of wall materials for thermal, strength and other technical and economic indicators, including, according to the main criterion, low cost in 2000-3000 rub / cu. Such a low-cost price in comparison with other wall materials does not require imported components, since it is produced from local loams in thermal furnaces on local gas.

e) Collapsible roads runways of polar airfields and military airbases in the Arctic with a surface of ideal smoothness and a large maintenance-free period.

f) Freight and oil and gas sea terminals, ports and piers on the Arctic coast.

g) Artificial islands and collapsible drilling bushes in swamps, lakes and shallow shelf with base freezing by industrial site.

h) Deep-sea caisson drilling stations (such as the "underwater bell") mounted from steel-solid spherical fuller tubing.

i) Submarine domes from petrositall for the collection of methane in places of intensive emission on the shelf.

j) Pipelines, slurry pipelines, water pipelines with wear-resistant petrositall lining supported by screw kriosvai with the possibility of more economical heating of pipes by a heat pump. Water lines with such lining will allow to export clean drinking water to the countries of Asia.

k) Underwater starting shaft complexes of steel-xylene cylindrical and spherical tubes. As an option, it is possible to build non-magnetic underwater vehicles and boats for depths of more than 1 km.

l) Steel-fibropetrositall composite armor plates for mounting on armored vehicles and collapsible defensive structures. With a greater impact strength, the composite steel-fibropetrositall is three times lighter and forty times cheaper than the latest armored alloy steel.

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

m) Manufacture of geomodifiers of a new generation of rubbing based on volostonite for the unpacking repair and restoration of tribo nodes in machines and mechanisms. The use of such geomodifiers increases the service life of machines by two or four times.

n) Production of petrositall plain bearings with higher tribotechnical indices and low cost.

Thus, it becomes possible to build runways, artificial islands-atolls for offshore gas and oil production in the shallow sections of the shelf, arrange sites for the needs of oil and gas producing enterprises and other production needs with higher (at times) functional quality indicators and lower cost [8]. A distinctive feature of the traditional road, railway or airfield construction is the principle of supporting the pile-trestle structure both on screw piles and on the earthen embankment on the road surface through a damping and unloading layer of expanded polimer or penotorfosilicate concrete that takes on vibrations and vibrations. In this case, the entire load of the heaviest road train, train, plane is evenly distributed over the surface of the ground. The regulating device on the head of the screw pile allows to ensure an ideal evenness of the working surface.

At the core of the pile-trestle road structure are two elements: a reinforced road-airfield-bridge plate of two standard sizes and a helical cryostat. The use of stone car, railway and airfield reinforced slabs with a flexural strength of 33.0 tons of screw kriosvai and thermosyphons allows the base to be frosted to the lowest possible temperatures and to eliminate thawing and deformation of the bases in the summer. Since the efficiency calculations are carried out for the entire period of the innovation technology, i.e. 5-10 years, all values of the indicators of future periods are discounted to the present time. The discount factor considers the banking rate and inflation.The implementation of scientific results can positively affect the main performance indicators of oil and gas producing enterprises due to:

Increase in revenue from sales growth:

a) accelerating the pace of construction.

b) saving gas consumed for own needs and reducing its losses.

Decrease in material and energy costs due to:

a) use of new equipment, new technologies and technological processes

b) innovations aimed at reducing the consumption of material resources

c) use of import-substituting materials

d) replacement of materials used in production, raw materials or semi-finished products with cheaper ones

e) optimization of schedules and methods of production of capital and current repairs

f) reduction of costs for capital and current repair of infrastructure facilities

g) increase the maintainability of equipment

Reducing the cost of living labor due to:

a) use of new equipment, new technological processes

Developments aimed at saving time:

a) increase in between-repair periods

b) increase in the level of intensification of production.

Economy of capital investments:

a) improvement of technical, technological and organizational solutions for the construction of buildings, structures and facilities

b) Increasing the useful life of machinery, equipment, vehicles and other types of fixed assets

c) optimization of corporate capital construction programs

d) use of advanced technical, technological and organizational solutions

e) optimization of gas transport and transport flows

Factors associated with improving the quality of finished products and associated with the improvement of quality of price changes

Let us consider what gives rise to the quality of finished products by the example of the development and introduction of new types of building materials and structures. The technology of production of petrositall from various types of local raw materials and energy carriers developed at the TSU and TGASU allows the subsequent production of a wide range of composite petrositall structures and applications from them. The basis of the feasibility study of the production and application of petrositall structures is the principles of functional and cost analysis and quality management with an output to the integrated "price-quality" index.

The aim of innovation is to reduce the price and improve the quality of the transport infrastructure. In the Yamalo-Nenets Autonomous District "price" - the estimated cost of 1 km of a road of category III G8 on average fluctuates (depending on the specific conditions of the route) in the range of 80 - 150 million rubles. With traditional low "quality" indicators. The "quality" of the third category road with a hard surface as a composite indicator includes such key indicators as: warranty period of the maintenance-free period 1-3 years, dynamic load-carrying capacity (wheel load on the automobile axle) no more than 10 tons, maximum speed 90 km / hour, the evenness of the surface is practically not regulated

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

(subsidence, potholes, rutting and asphalt puffing - this is an attribute of Russian roads of III and IV categories known to all drivers). All these indicators of a sharp decrease in the quality of pavement on the northern and polar roads, occurring under the influence of frost heaving in winter and subsidence in the summer.

In our variant of construction of transport infrastructure with the use of petrositallite road slabs, additional indicators of the quality of the new material appear: petrositall: softening start temperature, °C, abrasion resistance, g / cm^2, bending and compressive strength in MPa, chemical resistance in% to acids and alkalis H_2SO_4, NaOH) and other indicators (Table 1). Calculation of the cost of 1 cu. meter of petrositall in mass production is taken, based on the technical and economic parameters of such traditional materials and structures as glass-crystalline materials that are close in technological parameters.

Cost structure of 1 cu. meter of petrositall in mass production includes:

a) Raw materials and materials - 40%

b) Salary - 30%

c) Energy - 14%

d) Amortization - 8%

e) Other expenses - 8%

In case of location of the petrositall production plant in the village of Kharp YaNAO, the cost of natural gas is -3 thousand rubles / cu. m. or $50 per thousand cubic meters. The gas consumption for thermal processes is about 400 cubic meters to produce one cubic meter of petrositall or 1200 rubles. Based on the unit cost of energy, we calculate the approximate cost of one cubic meter of petrositall. It will be equal to 8570 rubles.

From this it follows that the petrositalls are comparable in strength to bending and compression, but they are three times lighter in weight, not at all corroded, and, most importantly, 12 times cheaper.

Results of the Research

It is proposed to replace the traditional reinforced concrete structures with a new economically effective and ecologically expedient material - SCS, which fully meets the special conditions of the Arctic and with the possibility of its production from local raw materials. SCS and composite structures based on them are an innovative effective material to produce a pile-trestle road structure and construction on its basis of transport infrastructure, industrial and civil facilities in permafrost and the Arctic shelf.

Conclusion

In the course of the study, the possibility of obtaining petrositalls from the dump rocks of the basic and other composition of the three gold deposits of the Polar Urals has yielded the following results:

a) Theoretically calculated and experimentally refined compositions and technological parameters of the process of crystallization of pyroxene solid solutions for obtaining qualitative structural materials of SCS.

b) Investigation of the physicochemical properties of the obtained petrositalls showed that they correspond to the expected results and meet the requirements of modern industry.

c) The proposed technological solution can partially solve the problem of waste disposal of the mining industry.

d) At the current time, the methodology for obtaining new petrochemicals of the sikam class can be considered fully tested in laboratory conditions and ready for factory testing.

e) Petrositall and penosikam structures in the form of piles, plates, blocks, tubing and domed prefabricated elements are several times cheaper, stronger and more durable than concrete and metal.

References

1. Sarkisov PD, Orlova LA, Popovich NV, Schegoleva NE, Lebedeva YE, et al. (2011) The current state of the issue in the field of technology and production of ceramic materials based on aluminosilicate systems. Glass formation, crystallization and morphogenesis upon receipt of strontium-anorthite and celsian glass metals. All Materials 8: 1-19.
2. Zhunina LA, Kuzmenkov MI, Yaglov VN (1974) Pyroxene Sitalls - Minsk: Publishing house of BSU pp. 224.
3. Pavlushkin NM (1979) The basics of the technology of sitalls, pp. 359.
4. Strnad Z (1988) Glass-crystalline materials, pp. 256.
5. Artamonova MV (1983) Chemical technology of glass and glass materials. In: NM Pavlushkina (Ed.) pp. 432.
6. *Lö*csei B (1970) Molten Silicates and their Properties -Budapest. Academia Kiado, pp. 135.
7. Manankov AV (2012) Physicochemical fundamentals of nanostructured mineralogy in the production of modern materials. Vestnik TGASU 2: 120-136.
8. Manankov AV, Bychkov DA, Strakhov BS, Yakovlev VM, Bykov NE (2012) Mineralogical and geochemical and experimental studies of the synthesis of petrosital. Collection Mineralogy, Geochemistry and Minerals of Asia. Tomsk: Publishing house of Tom.unta, p. 10-18.
9. Manankov AV, Bychkov DA (2012) Mineralogical and petrogeochemical studies of the mountain raw materials of the Polar Urals for the production of petrosital. Materials of the 1st All-Russian Youth Conference Russia in the Arctic Tomsk: Polytechnic University p. 42-43.
10. Hasanova ER, Manankov AV (2017) To solve the problems of off-road mining in special conditions. Materials of the 63rd University Scientific and Technical Conference of Students and Young Scientists state architect builds Tomsk. Publishing house of TGASU C, p. 64-66.
11. Hasanova ER, Manankov AV (2017) Petrositall building constructions for oil and gas production in special conditions of the Arctic. Materials of the first Ryazan International Ecological Forum Healthy environment - the basis of regional security, pp. 124-136.

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.

12. Manankov AV, Karaush SA (2015) Development of a highly profitable technology for the production of porous vitrified blocks. Mater. Sat Scientific and innovative activity of the Tomsk sovereign. architect-build. University in 2014 Tomsk: TGASU S, pp. 126-127.
13. Rumi MKh, Nurmatov SR, Mansurova EP, Zufarov MA, Faiziev ShA, et al. (2017) Materials for boiler pipes surface protection. Glass and ceramic, 5: 29-33.
14. Rumi MKh, Nurmatov SR, Mansurova EP, Zufarov MA, Faiziev ShA (2017) Chemical resistance of materials based on fused mineral raw materials of Uzbekistan. Glass and ceramic 7: 32-36.
15. Manankov A, Vladimirov VM, Strakhov BS (2015) Mechanism for structure formation and non-equilibrium glass crystallisation model (a review). Glass and ceramic, p. 3-10.
16. Manankov AV, Vladimirov VM (2016) On the mechanism and thermodynamic modeling of metasilicate glass ceramics crystallization. Glass and ceramic 6: 3-7.
17. Deer WA (1966) Rock-forming minerals: pp. 236
18. Mandelbrot BB (1982) The fractal geometry of nature. New York: WH Freeman and Company pp. 464.
19. Pinsker GZ (1979) About one important property of short-range order in glasses. Physics and chemistry of glass 5: 509-516.
20. Schindler M, Berti D, Hochella MF (2017) Previously unknown mineral-nanomineral relationships with important environmental consequences: The case of chromium release from dissolving silicate minerals. American Mineralogist 102(10): 2142-2145.
21. Vigouroux H, Fargin E, Fargues A, Garrec BL, Dussauze M, et al. (2011) Crystallization and second harmonic generation of lithium niobium silicate glass ceramics. Journal of the American Ceramic Society 94(7): 2080-2086.
22. Romanov BM, Manankov AV, Sazonov AM (1981) On phase and structural relationships in the system of enstatite-diopside at atmospheric pressure. Geology and Geophysics 10: 67-76.
23. Loktyushin AA, Manankov AV (1997) Mineral structure in holographic model of substance. Structure and evolution of the mineral world. Syktyvkar pp. 35-37.
24. Medvedev EF, Minko NI (2017) Silicate glasses permeability to hydrogen. Glass and ceramic, p. 3-6.
25. Minko NI, Dobrinskaya OA, Gridyakin KN, Bulgakov AS (2017) Systematic approach to secondary products implementation in glassmaking. Glass and ceramic 5: 3-6.
26. Stookey JD (1959) Catalyzed crystallization of glass in theory and practices. Glass technology reports, 5:1-32.
27. Barbieri L, Ferrari AM, Lancellotti I, Leonelli C (2000) Crystallization of (Na_2O – MgO) –CaO – Al_2O_3 – SiO_2 Glassy Systems Formulated from Waste Products. Journal of the American Ceramic Society 83(10): 2515-2520.
28. Manankov AV, Salnikov VN (1996) Physical, chemical and electrophysical properties of petrurgic compositions. Physics and chemistry of glass 5(1): 84-86.

DOI: 10.19080/IMST.2020.02.555577

How to cite this article: Anatoly V Manankov. Structural Organization of Innovative Penrositalls from the Local Natural Raw Materials of the Polar Urals. Insights Min Sci technol.2020; 2(1): 555577. DOI: 10.19080/IMST.2020.02.555577.