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Heat Treatment of Polystyrene Solar Energy

L. Aruova, A. Utkelbaeva, A. Budikova, N. Saktaganova, G. Karshyga, U. Sarabekova and U. Abdikerova
Department of Architecture and Construction Industry, Polytechnic Institute, Kyzylorda State University, Kyzylorda, Kazakhstan

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Corresponding Author:
L. Aruova
Department of Architecture and Construction Industry, Polytechnic Institute, Kyzylorda State University, Kyzylorda, Kazakhstan

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Abstract: Solar energy is a powerful reserve of energy at the surface of the globe which is about 20 billion kW. This amount of energy is >100 times the amount of energy required for the entire planet; the use of this transmitter power is not related to polluting the planet with harmful substances. The use of solar energy today is very important, as is the particularly acute problem of traditional energy resources, due to their irreparable increase their value. In factories in the Republic of Kazakhstan, industrial manufacturing of building materials today outlined a trend for use of alternative forms of energy and basically solar heat treatment step which traditionally used steam heating. Solar thermal processing is a method of heat treatment of the sun and has many varieties. A certain type of building material is needed to select the optimum, cost-effective way solar thermal processing that the costs were minimal. These studies examined the development in the direction of heat treatment polystyrene concrete. The results of this study confirmed that the use of heat treatment methods of solar thermal processing polystyrene is an effective medium for the weather in Kyzyl-Orda region, relating to areas with dry hot climates necessary to carry out detailed studies of polystyrene in the weather conditions of high temperatures and to introduce them into production. The use of solar technology for the production of polystyrene concrete improves the quality of manufactured products will enable the reduction of energy consumption of conventional energy, covering the use of solar energy.

INTRODUCTION

Principles of solar thermal processing of concrete. Heat treatment of various kinds and types of materials for the construction demands for the production of a huge amount of heat energy. There are several effective methods solar thermal processing concrete products and structures for landfills. The main interest is the use of different combinations of translucent insulating helio-cover and helio-camera. This allows, for example, when combined solar thermal processing including with intermediate heat carrier at the sites year-round produce concrete products. Any of the presented methods solar thermal processing concrete contains its inherent features which determine their appropriateness application[1].

One of the main technical solutions for concrete solar thermal processing is considered helio-forms applications with different polymer translucent lids with a film coating. The point of this method is applied to the molded product moisture barrier coatings. Products are heated during the day by solar energy and the energy is released in the exothermal cement binder. For this purpose, the method is characterized by ease, efficiency and lack of complexity in implementing production. The implementation of this method in the production has no need for special equipment, for the application of various film-forming compositions can be used tools for doing the finishing. In the hottest (above 40°C) during the summer months with low humidity where evaporation of concrete occur very quickly this way solar thermal processing most effective. For intensive use of concrete hardening only film-forming composition is small[2].

Therefore, a professor Lyazat Aruova developed a new method of heat treatment in translucent concrete chambers with a preliminary application to the product of film-forming compositions for the dry and hot weather conditions. Film-forming compositions must comply with the non-toxicity, environmental safety, fire and explosion safety. These requirements are appropriate to use in the study of the efficacy (ERW) dispersed film-forming substances. The method described above solar thermal processing recommended for use in a landfill, located in areas South of 50° North latitude. Implementing this method will ensure the production of high-quality concrete with a projected strength with significant savings energy components. The thickness of the helium-processed products should be between 10-40 cm of concrete grade 150 (class V12,5) and above. Today scientists have conducted research in order to increase the operating season helio-ground and produce a wider range of products and designs. The main technical solution of this problem is the joint use of solar and conventional energy or combined by solar thermal processing. Separating helio-form heating sources for additional and duplicate course is arbitrary but it is done to identify the type of power source and the main features of its application for the heat treatment of sun-concrete products[3].

The use of additional sources that necessarily combined with the influence of solar radiation should compensate for the lack of solar energy to heat the complete processing of concrete products for their daily cycle production, usually in spring and autumn and even summer (rain, clouds, fog) periods of the year on the basis of their operational regulated inclusion. The preferred form of additional heat source is helio-form electrical energy. Heating elements are: Tubular (heating elements);

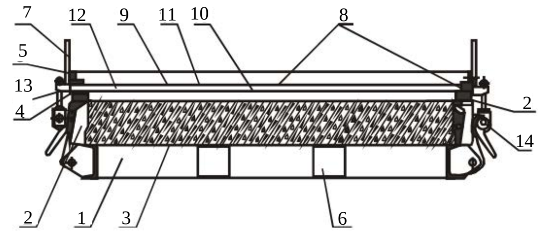

Fig. 1: Helio-form for heat treatment of concrete and concrete products using SVITAP; (1) Pallet, (2) Boards, (3) Concrete products, (4), Removable angled frame, (5) Pinch the corners, (6) Seal, (7) Lifting lugs, (8) Roll bar, (9) Upper distance grating, (10) Lower distance lattice, (11) A top layer of the polymeric material, (12) The bottom layer of polymeric material, (13) Seal and (14) Locking devices

different heating cables and wires; tubular rods and wires; flexible strip etc. Duplicate sources of energy must operate under adverse conditions (e.g., winter) almost completely replacing the solar energy. As a back-up method of hardening concrete by way of intensifying helio-ground during the cooler seasons, you can also resort to additional electro-warming concrete (Fig. 1).

Experience in the use of combined solar thermal processing concrete products previously was known as solar thermal processing when heating was carried out using SVITAP and traditional energy comes from conventional energy (electricity, steam). This way the cold season saves 748 kg of steam on each 1 m^3 structures provide the desired compressive strength of concrete at the age of 70% daily from R28 with high quality products manufactured from concrete. SVITAP is effective in cold periods. For example, when heating under SVITAP products with a thickness of 15 cm is possible to increase the degree of maturity of concrete in one day old warm helium compared to conventional forms in 1,4 2,8 times, while the strength of the concrete increases in 1,5-5,1 times[4].

Analysis of the various technologies in solar thermal processing concrete products showed that the most effective is solar thermal processing concrete products with the combined use of translucent plastic and heat insulating coatings. Especially, effective impact on concrete structures and products use a combination of translucent cameras simultaneously with the film-forming composition that protects against moisture evaporates when exposed to the rays of solar radiation with a large participation in the process isotherm binder-cement and dosed supply of thermal energy from other sources, with a lack of sunlight (Fig. 2)[5].

Therefore, more effective applications are needed of the combined use of the path solar thermal processing

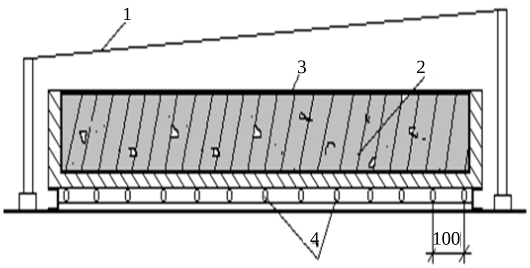

Fig. 2: The intensification of concrete hardening by warm electric heat in translucent chamber; (1) Translucent coating, (2) Fresh molded article, (3) Film-forming composition and (4) Warm electric heat

Fig. 3: Experienced helio-camera for heat treatment of concrete two-way supply of thermal energy Kyzyl-Orda

using translucent helio-camera preliminary application of film-forming substances with heating elements to duplicate energy. Figure 3 introduced other varieties of ways solar thermal processing dry hot protection of the Republic of Kazakhstan. The main difference between them is already available from the placement of the heaters above and below helio-cameras on the product. The thermal energy supply is carried out from above and below simultaneously when using this film forming composition and solar energy. Application of the combined solar thermal processing in helio-camera in the absence of solar radiation resulting in savings of 50 kg or more of coal equivalent (conventional fuel), >500 L of water[6].

The theoretical concept of work: Development of modern technologies with the consumption of solar energy for rapid hardening of concrete in the manufacture of polystyrene products will ensure high-quality polystyrene products due to the optimal structure of the concrete due to the creation of the optimal temperature and humidity environment of hardening concrete, rational formation of the temperature field in the products and heat and mass transfer.

Another area of application of solar energy to heat the intensification of hardening concrete designs and products a solar circulating intermediate coolant. In this case, the flow of solar radiation during the heating of products is not acting on the concrete and the solar absorber in which the coolant circulates intermediate (oil, water, etc.) and thus it is assumed that no solar thermal processing products are made of concrete and (HT-Heat Treatment) and the heat treatment product constructions using the coolant heated by solar energy[7].

Analyzing the experience of consumption of solar energy to heat treatment of concrete through the solar system with an intermediate coolant.

Today, all kinds of traditional fuels used in the industry natural gas, oil, coal, etc. are not considered to be renewable energy. Traditional types of fuels have certain reserves and cuts in their possible application will definitely dictate the pace of consumption. The trend to alternative energy circulation occurring around the world, explains how the possibility of the end of the traditional types of energy reserves as well as the critical situation and the environment caused by the burning of fossil fuels and the emergence of the “greenhouse” effect[8].

The use of non-traditional types of energy and transform them into the most suitable forms of exploitation heat and electricity today is quite expensive. Otherwise, the difficulties that await us in the event of consolidation or even preserving the growth rate of adverse effects on the environment as a result of exposure to industrial and power generation, force us to seek funds and engage in research aimed at the development of effective non-conventional energy such as solar energy.

The use of solar energy for heat treatment of concrete in the CIS and abroad has been the subject of a lot of research, a lot of experience products and designs of solar thermal processing in a production environment. One of the original parties to the use of solar power for the treatment of concrete products and designs is the use of solar systems with heat from the circulating intermediate coolant. In this case, the flux of solar radiation during warm-product does not act on the concrete and the solar absorber which circulates in the intermediate heat carrier (oil, water, etc.) and thus it is assumed that carried no solar thermal processing concrete products and heat treatment of materials using coolant which is heated by solar energy[9].

Operational approaches to intensification of polystyrene concrete hardening solar energy: In Kyzylorda State University developed a method combined solar thermal processing conventional concrete and polystyrene through the solar system with an intermediate coolant circulating in landfills and closed shops. (“Innovative patent No. 2010/1103.1 18.10.10 method of

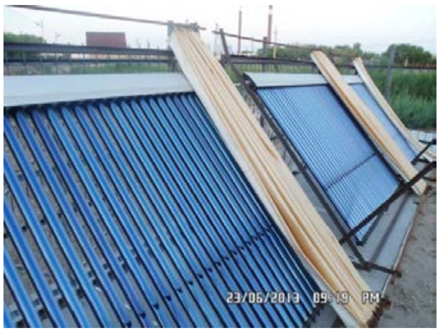

Fig. 4: The solar circulation with an intermediate coolant; Pilot plant

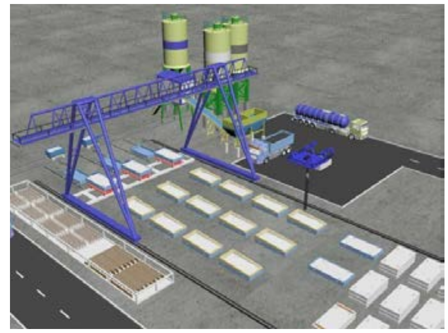

Fig. 5: Scheme open helio-ground manufacture polystyrene products

heat treatment of polystyrene products and structures"). The present invention is to provide high-quality products and designs, effectively using solar energy in spring and autumn and winter seasons with year-round solar systems with intermediate coolant circulation as well as the use of traditional types of energy in the absence of solar energy. In this helio camera or helio form the product under helio-ground pass by heat treatment cooked in summer seasons under helio-ground and in the Autumn, Winter and Spring seasons and in the absence of sunlight year-round helio-system connected with intermediate heat carrier. Solar thermal processing passes through the soft mode at a maximum temperature of 700° in the chamber or under helio-ground with increasing temperature rise of 4-7 h, the conventional isothermal aging products 6-7 h and cooling down to 35°C. The 100% humidity is created in the chamber due to the fact that the bottom of the chamber is filled with water. Strength of concrete is gaining 50-70% R28 at day old (Fig. 4 and 5). The method of thermal solar processing of polystyrene products will give year-round heat treatment, savings 50-100% of conventional fuels, environmentally friendly nature, high quality manufactured products and structures. Solar thermal processing through the solar systems with the use of an intermediate coolant was developed for polystyrene ("Innovative patent No. 25072. The method of heat treatment of polystyrene building products mixture. Kazpatent"). Today urgent to decision on the application of heat nearly all types of concrete including the lungs using unconventional energy solar energy.

Polystyrene: A concrete, where the filler is polystyrene foam. Polystyrene, although, in its basic qualities can be attributed to light-weight concrete or rather (aerated concrete) but it differs in several significant features. The main advantage is the possibility of change within wide limits of its density; the resulting polystyrene is not only structural but also heat-insulating material. Small bulk density polystyrene foam beads are allowed to produce concrete with a bulk density of within which may be selected in accordance with the destination area. This material can be used when constructing the roof and floor of the building the heat and sound-insulating material. Polystyrene can also be used to fill the voids in masonry underground structures, ideal for surround and other fillings which require the highest heat and sound insulation properties. Polystyrene is used in blocks and panels for exterior walls and partitions. Polystyrene can be used in the various panels of any dimension[10].

New methods of organizing solar thermal processing technologies for different types and kinds of concrete products in the dry hot environments Kyzyl-Orda region of Kazakhstan will enable savings of 50-100% of conventional fuels environmentally friendly nature, without the emissions from fuel combustion, high quality and low cost of concrete products and designs.

MATERIALS AND METHODS

Materials and equipment for the manufacture of polystyrene. Requirements for materials used for concrete. In the manufacturing of concrete products with solar thermal processing using film forming agents, polymer translucent solar cells as binding materials are recommended for use in Portland cement and 400 above that meet the standards of GOST 10178-85, GOST 22266-78. "The most effective a quick-hardening Portland cement and slag cement as well as cements whose activity is by steaming GOST 310.4-81 and SNIP 5.01.23-83 is the following: If the brand of cement 400-24 MPa, the same 500-28 MPa, however, 550 600-33MPa.

In the natural hot conditions Portland cement sulfate was used with mineral supplement Shymkent, Karaganda factory mark M400. Under laboratory conditions used Portland cement Shymkent, Karaganda factory mark M400. Main characteristics of the use of cement are shown in Table 1 and the chemical and mineralogical compositions in Table 2 and 3[10].

Aggregates (crushed stone, gravel, sand) satisfy the requirements of GOST 10268-80 and GOST 26633-85.

Table 1: Main characteristics of portland concrete

Types of cement	Normal density test	Terms setting (min) Beginning	End	Strength 28 days of age (MPa) Compression	Bending
1	2	3	4	5	6
Portland cement of Shymkent city factory	26.3	194	274	6.6	32.6
Portland cement of Karaganda city factory	26.1	301	461	6.2	44.1

Table 2: Chemical composition of cement

Title cement	CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	SO_3	П.П.П
Portland cement of Shymkent city factory	66.52	22.45	5.05	4.95	-	-	4.51
Portland cement of Karaganda city factory	66.3	22.2	5.6	4.6	1.8	0.38	-

Table 3: The mineralogical composition of cement

Title cement	C_3S	C_2S	C_3A	C_4AF
Portland cement of Shymkent city factory	61.7	21.0	5.1	15.2
Portland cement of Karaganda city factory	62.1	14.1	7.6	15.1

Table 4: Granulometric composition and sand gradation

Batch No. of sand	Full sieve residue (%) when its size (mm) -	2.5	1.25	0.63	0.315	0.14	Passed through a sieve 0.14 MM (%)	Gradation factor
-	-	1.4	4.0	15.9	49.5	93.1	6.9	1.64
2	-	2.2	6.3	19.7	65.4	94.3	5.7	1.88
3	-	21.8	28.6	55.5	92.0	99.0	1.0	2.74

Table 5: Grain composition of coarse aggregate

Type of aggregate	Private residue sieve (%) when the amount of 20	10	5	The No. of aggregate sifted sieve size 5 MM (%)
Limestone rubble	16	80.6	3.6	1.1
Granite rubble of Shetpinsk quarry	0	55.6	40.8	3.8
Crushed granite of Tastak quarry	5.88	60.1	23.21	10.92

Table 6: Technical specifications for polystyrene

Parameters	TY	According to the analysis
1	2	3
Water % by weight beads	1.1	1.86
Granulometric composition:		
The average particle diameter (mm)	1.1	0.2
The residue on the sieve with a diametrical hole (mm) 2.5 (%)	1.1	0.2
The residue after screening on the pallet on a 0.8 mm sieve	2.1	0.2
Apparent density (kg m^{-3})	16-31	13-16
Yield flexural strength at said apparent density (kgf cm^{-2}) is not less than	1.4-2.86	1.59

Fine aggregate was taken quartz sand three parties. The bulk density of the sand of these parties was in 1550, 1526 and 1448 kg m^{-3}; the amount of clay and dust was not higher than 2.2, respectively; 1.7; 0.4%. Grain composition, module size used sand are given in Table 4. Application sands meet GOST 8736-77. From Table 4 grain structure and module size sands[11].

Coarse aggregate used limestone rubble fractions 5-20 mm; granite rubble fractions 5-20 mm. The density of limestone rubble was 1291 kg m^{-3} and the density of granite rubble 1393 kg m^{-3}, grain composition of coarse aggregate is shown in Table 5. The grain composition of coarse aggregate, determined in accordance with GOST 8269-82. The content of clay, dust particles, in all cases did not exceed 0.4-0.7%. Rigid meet GOST 8267-82. From Table 5 grain composition of coarse aggregate.

Upon receipt of polystyrene coarse aggregate, expanded polystyrene fraction Ø5 was selected. Specifications for polystyrene gravel are given in Table 6.

Manufacturing technology of polystyrene in polymer solar cells. Technology for producing polystyrene products: this technology includes the following stages: foaming polystyrene beads; drying polystyrene beads; dosage of raw material components; production of polystyrene; polystyrene molding; hardening in polystyrene polymer solar cells; cutting the array into blocks of concrete and storing goods. Heat treatment is carried out by methods under helio-covers or translucent

Table 7: Composition of polystyrene

The composition of polystyrene					
Cement BTC M500 (kg m^{-3})	Polystyrene foam (L m^{-3}), Ø 5	Quartz sand (kg m^{-3})	Water (L m^{-3})	Superplasticizer-3 (kg m^{-3})	Beaded polystyrene is not granular (kg m^{-3})
200,0	850,0	150,0	80,0	0,8	3,0

chambers of different design solutions. Helio-covers should fit snugly to the sides of the form and connect to form locking boards. Helio-covers design should ensure: the height of the distance between the surface of the concrete and Fresh molded concretes lower part by helio-covers should be no >20-30 mm. In the form of a translucent material used: unpainted plastic film stabilized grades SIC, ST, T, M (GOST 10354-82) thick 100-300 mkm; Polyvinylchloride film technical grade B (State Standard (SS) 16272-79) with a thickness of 230 microns-PVC (B); Glass thickness of 4-6 mm[7].

Thermal insulation helio-camers and helio-forms have a special place insolar thermal processing. Helio-forms heat insulation reduces heat loss by helio-covers accumulated by the surrounding air and increases the formation of uniform temperature fields in concrete products as well as massive and reduces the time to reach the design strength concretes. For insulation with helio-form solar thermal processing methods, air layers of 20-30 mm were used. Effectiveness of the insulation can be improved by increasing the number of layers. Solar thermal processing material for insulation forms shall be appointed in accordance with the requirements of the exploited conditions. Recommended materials are listed in Table 7.

Styrofoam. Design of polystyrene performed computational and experimental methods. Was tasked with the manufacture of polystyrene thermal insulation class B 0,5-B 1 with an average density of 250-800 kg m^{-3}. Any part of the calculated adjusted during solar thermal processing considering the effect of temperature and the degree of dilution of polystyrene mixture at formed structure[12]. The dosage of the components was carried out for polystyrene cement by weight, for quartz sand the volume and weight, polystyrene, water and additives on volume. The components were mixed for one minute in a dry state and an additional 4 min with the addition of water. Mobility of polystyrene mixture was determined after 5 min after completion of mixing in accordance with State Standards (SS) 10181.1-81. Polystyrene concretes designed for fast setting Portland cement. The following compounds (Table 7).

In the study of the properties of concrete mixes, concrete structures used the following methodology. Workability, characterized by mobility, defines a standard cone GOST 10181.1-81. When this batch of concrete mixture samples were taken twice and measured slump average taken. A seal carried on the vibrating table concrete vibration duration 40 sec when vibrated increase starts separation from the solution in the aggregate mixture. Fresh molded sample remained in helio-forms in polymer solar cells approximately 22-24 h and then make a form removal and the samples were placed on the finished goods warehouse[13].

Concrete class defined compression standard sample cube dimensions 150×150×150 (100×100×100) mm molded by the developed technology. Experiments were carried out in 28 day interval, according to GOST 10180-90. Tests for determining the density of concrete was conducted for a series of concrete specimens weighing, according to GOST 7005-86.

Portland amount of spending 180-400 kg m^{-3} was made to obtain the required mark density polystyrene and expanded polystyrene according to brand and sand. Expenditure shall be appointed from silica sand conditions fill the voids between the grains in the polystyrene mixture. Water consumption shall be based on the projected concrete workability. Axial compressive strength was determined on specimens 100×100×100 mm cubes[14].

Thermal parameters of an experienced concrete determined by the following procedure: polystyrene samples requested density sizes 150 h, 150 h, 150 mm, dried according to GOST-7076 on the thermal conductivity properties and then measured the thermal conductivity of the device IT-1, “Phoenix Center” Cherepovets.

Study of the structure of cement stone. In the study of cement stone polystyrene used differential-thermal, radiographic, microscopic analyzes. The degree of hydration of clinker minerals conducted differential-thermal method. X-ray study was conducted on cement, cement stone powder polystyrene in 1 daily, 28 day old. Porosity of cement paste was determined according to State Standards (SS) 12730.4. Water absorption of cement paste was determined by State Standards (SS) 12730.3.

Control of the heat treatment of polystyrene: When large-scale introduction of solar thermal processing products and designs along with design optimization helio-covers and taking into account technological features of manufacturing polystyrene in a production environment. On a hot summer day period, the ambient temperature is kept quite stable, so, this method allows very precise control to fix the strength of the concrete during curing and at its end. In parallel with the

Table 8: Technical parameters of devices for temperature control

	Characteristics			
Device type	Constructive design	Accuracy class	Temperature measurement range (°C)	No. of connected points
The recorder of measure voltage 1	Showing and recorder	1	0-200	1
The recorder of measure voltage 3	Same	0,5	0-100	1
The recorder of measure voltage 4	Same	0,25;0,5	0-1000-200	1; 3; 6; 12
Industrial power	Same	0,5	0-1000-200	12; 24
Equivalent Series Resistance (ESR)	Same	0,5	0-100	1
Thermo-hygrometer	Same	-	0-60	1

monitoring of concrete hardening using graphs, the main role takes control of strength parameters of concrete products. When solar thermal processing and virtually identical technological parameters of the production strength of concrete products depends on the density of the radiation flux, ambient air temperature, wind and other climatic factors. Depending on the strength of their daily used solar thermal processing concrete in the hot season can vary from 40-80% Rn.t.28. Therefore, if at landfills operating in a customary control only normalized values of concrete strength (transfer, selling and age in the project), to control the strength of concrete helio-ground need to approve use routing products: extension solar thermal processing, adding additional conventional resources of energy, placement of products in the post ripening with follow-up care, in stock of finished products for the consumer and leave etc.

Controlling the strength of concrete is the main control of its physical and mechanical properties an integral part of the technological updating of the production of concrete products. Therefore, the choice of circuit components controlling the strength of concrete (methods and devices for testing and evaluation methods, etc.) is determined by the characteristics of the product (size and shape), a type of concrete. It also depends on the patterns of production and productivity of helio-ground. For the increase of concrete strength developed control technique which includes graphic depictions of concrete strength with increasing and decreasing temperature curing, concrete samples, temperature control in the process of hardening concrete, non-destructive testing after the end of the concrete curing. Every day, three or four times a day (at 9 am, 12 pm and 9 pm) mandatory measures the temperature of the ambient air. Graphic concrete strength with increasing temperature curing laboratory plant built in conjunction with a university laboratory specifically for concrete, used for production of portland cement M400 Karaganda fabricated samples cubes measuring 10×10×10 cm 6 pieces and they were kept in the same cells where the hardened concrete in the products. The samples were prepared each day for each type of product, if used for the manufacture of different compositions of concrete. Samples were tested every three hours after heat treatment. During the year with negative temperatures selected samples warmed electro-warming specially manufactured for sample forms with steel sides and bottom and with partitions made of Getinaks. Wall forms electrodes were heated and held at the desired temperature of the samples such as in the products of withstand. It is necessary to clarify that the cube control gives great accuracy in the determination of this parameter in the concrete products but allows some degree of approximation to control the behavior of concrete hardening. Temperature control in the process of hardening of concrete samples was carried out in pilot thermocouples installed in concrete products. Next, the temperature was checked on the upper surfaces of products by means of electronic thermometers[15].

Maturity index is the benchmark for monitoring modes of hardening concrete products. During the curing of the concrete measures the temperature and the amount of the acquired degree-hours and on these indicators was determined by the maturity of concrete. The techniques used and the temperature control apparatus are shown in Table 8.

In sublot controlled stripping strength of concrete. During one shift manufactured products sublot. Articles belonging to the same species and concrete of a class are sublot. In the range of 2 or 3 days are made 2-3 sublot which make up the party. Selling strength is controlled by STST18105-86.

Nondestructive testing of concrete in the manufacture of products is carried out using sclerometry. The same method was tested before the test on the press and control samples. Sclerometric method validates the strength of concrete in each product not only immediately after the heat treatment but after standing in piles in the summer before sending the finished product to the construction sites. The results of all types of control are fixed in special journals laboratories. It should be emphasized that the defective product due to heat treatment is practically absent. The observed defects were mainly due to technological errors (bad concrete compacted bundle of concrete due to poor mixing, etc.). The developed system of quality control of concrete completely justified.

RESULTS AND DISCUSSION

Physical and technical characteristics polystyrene and building solar technology in their production. Compressive strength, frost resistance and thermal conductivity polystyrene.

Table 9: This test frost resistance of concrete

	The strength of concrete compressive samples, coefficient of frost (MPa)			
		After the alternate freezing and thawing cycles through		
Hardening conditions concrete	Control	100	200	300
1	2	3	4	5
Average hardening	31,7	1,05/33,3	1,05/33,4	1,07/34,0
Solar thermal processing in solar cells under the translucent film-forming substance	33,5	1,09/36,4	1,10/37,0	1,15/38,4

The study used concrete on the following raw materials: Portland cement M400 Karaganda plant, crushed granite Tastakquarry 5-20 mm fraction, quartz sand with a fineness modulus of 2.2. Was used by an experienced concrete mix of 1: 1.61: 4.03 at 0.45 water-cement ratio and slump 1-3 cm, the ambient temperature t = 14°C. Experiments were carried out on two groups of sample cubes: the first part of the samples coated with film-forming substances are placed in a translucent solar cell, the second part of the samples did not cover anything and placed in translucent solar cell. Both groups of samples were subjected to the method of solar extension solar thermal processing through solar systems with an intermediate coolant in translucent chamber[16].

In this method, as the concrete is heated by solar energy and by duplicating helio-system through an intermediate heat transfer medium and also due to the exothermic process in the binder. In the accepted age of 1, 3, 7 and 28 concrete specimens were tested in compression. The results of these experiments are presented in Table 9 and Fig. 6.

Extension using UPU translucent helio-camera with intermediate heat carrier; 1'extensionuncoated translucent helio-camera with intermediate heat carrier, 1 natural hardening without care.

From Table 9 and Fig. 6 shows that the strength of concrete, in a sunny helio-camera are coated with a film-forming substance above 20% compared with the strength of the concrete as become solid in the process in solar camera, but without applying a coating composition.

To study the kinetics of hardening polystyrene concrete samples produced brands D600, D500, D450, D400, D350, D340, D300; D250. Instead of the quartz sand was injected polystyrene bead.

This study given increase strength polystyrene grades D800, D500, D350solar thermal processing in the solar helio-camera. This study shows the increase in strength of the samples of polystyrene natural environment at the same average density. From the graphs we can see that for samples of identical average density, strength heat-treated samples in the solar camera polystyrene concrete higher than the strength of samples formed in the natural climate of 50-100%. Based on this structure of the test samples remained sufficiently good, there was no visible fiber bundles.

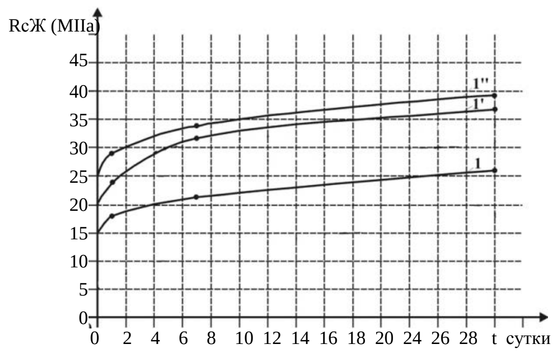

Fig. 6: The growth kinetics of concrete strength processed by the method of combination solar thermal processing

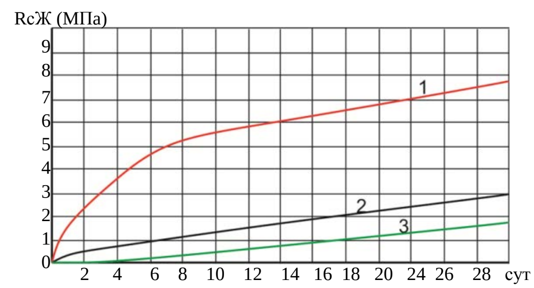

Fig. 7: Height strength normal polystyrene concrete solidification at BTC M500

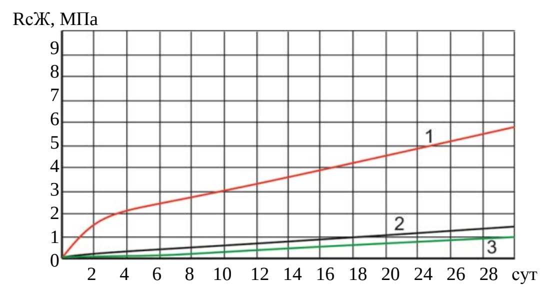

Fig. 8: Samples of polystyrene

Interval duration of solar thermal processing 22 h. Modes of solar thermal processing universal for polystyrene D800, D500 and D350 (Fig. 7 and 8).

Polystyrene samples D800 brand reach a translucent chamber solar with intermediate coolant 7.9 MPa,

Table 10: Results of experiments on the frost resistance of concrete

	Strength concrete specimens in compression (MPa) coefficient of frost			
		After the alternate freezing and thawing (Cycles)		
Way of solar thermal processing	Control	100	200	300
Solar thermal processing using solar energy through solar systems with intermediate heat carrier	32,8	37,4/1,14	38,7/1,18	39,4/1,2

whereas in a normal environment 5.6 MPa, brand D500 samples reach translucent intermediate heat chamber 3 MPa. In a normal environment of 1.1 MPa, polystyrene concrete brand D350 achieves a translucent chamber Solar with intermediate coolant 2.8 MPa and in a normal environment 0.9 MPa. Developing new ways of combination solar thermal processing in translucent solar cells using solar with intermediate heat carrier and other conventional energy sources for polystyrene, a thermal camera using film-forming composition deposited on the surface of the fresh molded concrete to achieve high strength characteristics.

Frost resistance of polystyrene: Frost resistance of concrete is the possibility of concrete when saturated with water resist reusable alternately freezing and thawing. Freezing rain creates pressure in the pores and microcracks and is the cause of the destruction of concrete. Freezing water increases in volume by 9%. In the solid concrete skeleton of a voltage at expansion during freezing water, the cyclical nature of freezing and thawing of concrete leads to a weakening of the structure and loss of strength. Frost resistance of concrete is determined by alternate freezing and thawing. The determining factor in assessing frost resistance of concrete is considered to be the number of cycles when the decrease in weight of the sample of concrete at least 5% and its strength properties are reduced to 25%. The number of phases alternate freezing and thawing of concrete sets mark for hardiness: to heavy concrete F50-F500 and it is appointed in accordance with the terms of use of its products and designs.

In connection with the planned use ofsolar thermal processingconcrete structures in different regions of the country there is a need hardiness trials are ordinary concrete.

One of the most important technical characteristics of concrete structures is their hardiness. Frost resistance of concrete structures is determined by its structure, especially the character of porosity as the latter will determine the location of missed and water in the body of the material at temperatures below zero and hence the value of emerging tensions and speed the process of loosening of the concrete structure.

The frost resistance of concrete greatly influence the conditions of its hardening. Therefore, it is necessary to consider the frost resistance of concrete, hardeningin polymer solar cells coated with a film-forming agent, trials were conducted by the authors. The tests were carried out on the frost on standard samples of size 10×10×10 cm, reaching grade strength. Composition of concrete W/C, UC analogous data in Table 7. The data on the tests on concrete specimens contraction are shown in Table 10.

Experiments have shown that the strength of the sampleshardeningin polymer solar cells are coated with a film-forming substance, 28 diurnal period show high strength concretes, concretes formed higher than in a normal environment. Concrete frost resistance tests revealed that the hardening in polymer solar cells with a film forming agent gives 300 phases of freezing and thawing, when the frost factor reaches 1.15. This time, the coefficient of frost resistance of concrete formed in a normal environment and subjected to the same tests equals 1.07. It should be noted that when administered in combination with studies solar thermal processing applying a coating composition to apply electro-thermal scheduled test, the samples were subjected to frost, past pre-defroster coated with a film forming agent and a film forming method of the composition without electrical heating and sampleshardeningin a normal environment[17].

The tests were carried out on the frost on interstate standard GOST 10060.2-95 “Accelerated methods for determining frost after repeated freezing and thawing”. Table 11 shows the results of concrete frost. In consideration of the table it can be concluded about the samples heat-treated in the solar helio-camera equipped with heated through solar systems with intermediate coolant that these samples are stored 300 test cycles with frost Coefficient of Frost (CoF) = 1.2 (Table 12).

Indicators frost polystyrene are within 75-100 cycles of freezing and thawing. The thermal conductivity of polystyrene.

“In order to test the thermal conductivity of polystyrene used GOSTR51263-99. Styrofoam. Specifications”. Polystyrene samples were molded in metal molds size 150×150×150 mm. Composition taken polystyrene following: Portland-BTC M500, expanded polystyrene beads-(γ = 15 kg m^{-3}), silica sand γ = 1572 kg m^{-3}, drinking water, super-plastificatorC-3, non-expanded polystyrene granulated. In the experiments used soft modessolar thermal processingin solar cells with a film-forming substance samples are heated up-50-600S,

Table 11: Frost polystyrene

Mark polystyrene density	D300	D350	D400	D450	D500	D550	D600
Mark on frost resistance of polystyrene	F35-F50	F35-F50	F50-F75	F75-F100	F75-F100	F100-F150	F100-F150

Table 12: Indicators of the thermal conductivity of polystyrene

Mark density polystyrene	Sample 1, λ, (W mλ^{2}°C)	Sample 2, λ, (W mλ^{2}°C)	Sample 3, λ, (W mλ^{2}°C)	Average value, λ, (W mλ^{2}°C)
D 400	0,103921	0,104951	0,104971	0,104611
D 300	0,080021	0,079122	0,081219	0,080110
D 245	0,073202	0,073122	0,074487	0,073637

Table 13: Results of semi-quantitative phase analysis of the sample number 1 polystyrene. Heat treatment under the sun under the film

Ref. code	Compound name	Chemical formula	Semi quant (%)
01-086-0402	Tricalcium silicon pentoxide	$Ca3\ SiO_5$	26
01-089-6427	Sodium tecto-alumotrisilicate	$Na(Al\ Si3O_8)$	28
01-083-0539	Quartz, syn	SiO_2	46

Table 14: Results of semi-quantitative phase analysis of the sample No. 2 polystyrene. Heat treatment in a solar cell

Ref. Code	Compound name	Chemical formula	Semi quant (%)
01-085-0795	Quartz, syn	SiO_2	16
01-073-0599	Tricalcium silicate oxide	$Ca3\ (SiO_4)\ O$	22
01-070-1433	Magnesium carbonate trihydrate	$Mg\ CO_3\ (H_2O)_3$	11
01-083-1612	Albite, high, sodium tecto-alumotrisilicate	$Na\ (Al\ Si3O_8)$	31
01-086-0402	Tricalcium silicon pentaoxide	$Ca3\ SiO_5$	20

Table 15: Heat treatment in a solar cell

Temperature measuring point product	Concrete temperature (°C) Maximum	At the end of cycle	The total No. of degree-hours
1	60	28	869
1,	59	28	864
2	58	27	860
2,	59	26	858
3	58	27	853
3,	57	26	856

During the experiment, the temperature was in the range 36-25oS

cooled to 30-350S. Conductive properties of polystyrene grades D245, D300, D400, measuring device for determining the heat transfer performance of IT-1, Cherepovets branch "Phoenix Center" Vologda Scientific Production Association. Interval measurement of thermal conductivity of the device is in the range of 0.04-1.0 W/m^{2}°C, temperature scale measurements lies in the interval from -30°C to +50°C, maximum permissible error of measurements can be in the region of 10%. The measurement of the thermal conductivity was performed on prototypes of polystyrene (Table 13).

The thermal conductivity of polystyrene heat-treated in a manner solar thermal processing applicable to the requirements of thermal insulation structures. Investigation of the structure and phase formation of cement stone polystyrene[18].

Micro-morphology: Electron microscopic examination of samples polystyrene performed on a scanning electron microscope-microprobe Jeol JSM-6490 LA. Formulations were prepared by the standard procedure without shading metallic surface. The accelerating voltage at the anode was 7 kV, at least 100 portions of which have been selected most typical. Set magnification was chosen as follows: x500, 2000 and 5000-fold.

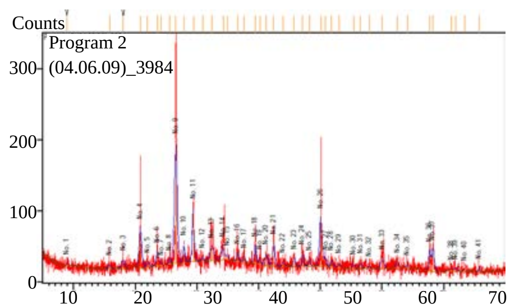

Fig. 9: The XRD pattern of the sample number 1 polystyrene. Heat treatment under the sun under the film

Radiography: X-ray studies performed on polystyrene diffractometer X-PertPRO using complex computational programs of this unit. Preparation of the samples was carried out by powder phase analysis described in/5/-(Kovba, Trunov) (Fig. 9-11 and Table 14, 15).

The results of X-ray phase analysis 3984 (Fig. 9) where the number of identified phases, Ref. Code Stock No ID card, Compound Name the name of the phase, Chemical Formula, the number of the selected phase as a percentage.

The results of X-ray phase analysis 3987 (Fig. 12) where the number No. identified phases, Ref. Code Stock No ID card, Compound Name the name of the phase, Chemical Formula a chemical formula, the number of the selected phase as a percentage (Fig. 13-15).

Solar thermal processing polystyrene concrete blocks with the application of a film-forming substance in a translucent chamber with an intermediate coolant warmed up to a maximum of 52-53°C, cooled to 28-27°C.

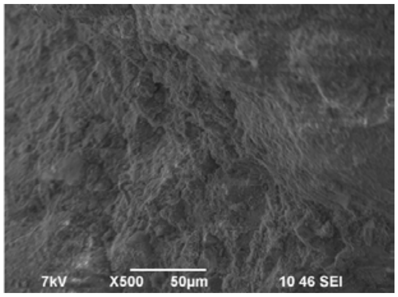

Fig. 10: The morphology of the sample number 1, section 1×500, SEM polystyrene. Heat treatment under the sun under the film

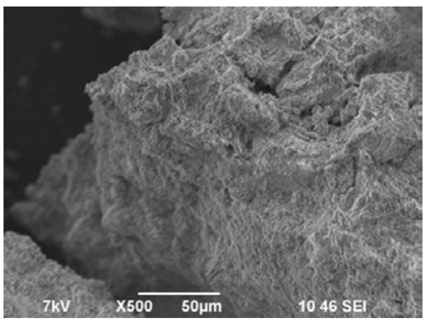

Fig. 11: The morphology of the sample number 1, section 2×500, SEM polystyrene. Heat treatment under the sun under the film

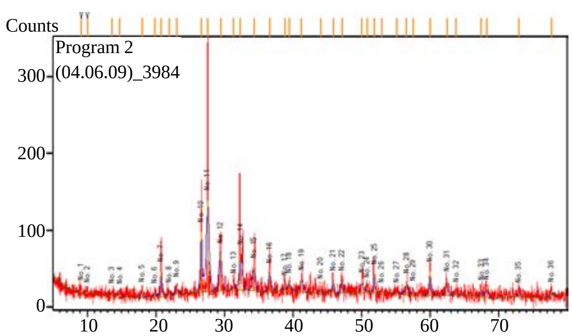

Fig. 12: The XRD pattern of the sample number 2 polystyrene. Heat treatment in a solar cell

Intermediate coolant temperature reaches 69-68°C. Maturity was 1000-950° per hour. Maturity polystyrene concrete in a translucent chamber with an intermediate coolant 15-20% higher concrete, film-forming composition solar thermal processing under *in vivo* (Fig. 16).

Data processing radiographs are summarized in Table 14 and 15. From the analysis of this table shows that the composition of all the samples present silica SiO_2. Followed allocate calcites Ca (CO_3), (Mg0.03Ca0.97)

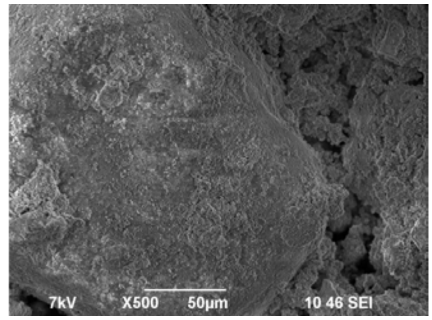

Fig. 13: The morphology of the sample number 2, section 2, ×500, Scanning Electron Microscope (SEM) polystyrene concrete. Heat treatment in a solar cell

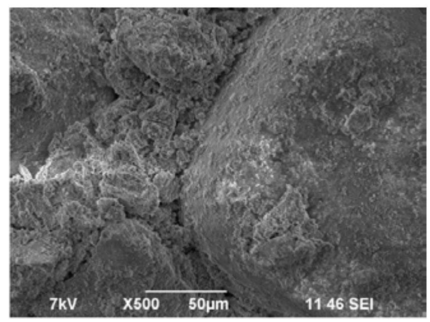

Fig. 14: The morphology of the sample number 2, section 1, ×500, Scanning Electron Microscope (SEM) polystyrene concrete. Heat treatment in a solar cell

(CO_3) and calcium and magnesium carbonates in a hydrated form Mg CO_3 $(H_2O)3$. Note also the presence of calcium and magnesium silicates, aluminum silicates, aluminates and iron sulphides. Analyzing the composition of the starting components as polystyrene and foam concrete, it can be concluded about the consistency of the results of phase analysis of samples submitted for study.

In general, these X-ray analyses of the cement stone and concrete, obtained based on a study of undergraduates enveloping replicas by transmission electron microscopy, are also within the previously developed ideas about the physical and chemical reactions that take place during the formation of concrete using different technological methods and the introduction of certain additives in the starting material. However, the high increase in the transmission electron microscope and a technique of enveloping replicas gave only indirect information about the micro-structure of cement stone[19].

Direct surface plane study some stone cement particles by scanning electron microscopy to obtain additional information on the previously obtained micro-structure individual structural elements in a wide magnification range from 500-5000-fold.

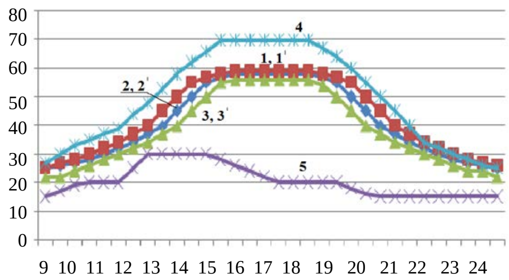

Fig. 15: Changes in temperature slabs PAG-18 and sample cubes in their solar thermal processing in translucent solar cells under the film-forming composition to the intermediate coolant; 1, 1', 2, 2', 3, 3' the place of installation of thermocouples in polystyrene concrete; 4 intermediate coolant temperature; 5 temperature

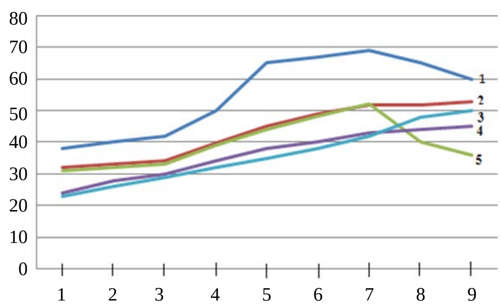

Fig. 16: Changes in temperature of the polystyrene block size 200 h, 300 h, 600 mm during solar thermal processing; (1) Intermediate coolant temperature, (2) Temperature polystyrene concrete in translucent solar cell under the film-forming agent with Solar with intermediate heat carrier, (3) Temperature polystyrene concrete in translucent chamber uncoated with solar and intermediate coolant, (4) temperature in the film-forming composition of polystyrene concrete under in vivo conditions and (5) Temperature polystyrene concrete in translucent cell *in vivo*

Returning to the data analysis phase as a fairly objective integral method for investigating and analyzing as polystyrene by heat treatment in the solar cell and the heat treatment under the sun under the film traces the difference in the phase composition of mineral components and their proportions.

When analyzing the percentage of silica in the polystyrene after the solar chamber (2) and heat-treated film under the sun (1), in case 1, SiO_2 = 46% in the case 2, SiO_2 = 16%.Ca3 SiO_5 case 1-26% and 2-20%. Na (Al $Si3O_8$) 1-28 and 2-31%. In addition, when a heat treatment under the sun film additionally detected phase Ca3 (SiO_4) O and $MgCO_3$ (H_2O)3. The presence of tricalcium silicate oxide in an amount up to 22% indicates that the interaction of sand and cement in two conditions occurs considerably better than 1.

The presence of hydrogen in magnesium 2 of 11% confirms the conclusion of the differences in the processes taking place in the polystyrene concrete prepared according to the study

Morphology polystyrene concrete scheme 1 versus 2 also shows significant differences in micro-structure polystyrene samples prepared by methods 1 and 2. Samples 1 can be described as a homogeneous friable.

Composites reinforced with needle-like crystals are randomly oriented in an array of cement stone. Cement stone pattern formed of two laminated assemblies, whose surface is dotted with small polyhedral grains, a size of about 100 nm and individual flat flakes with dimensions of from 0.5-100 μ and above. Traces reinforcing needles are oriented approximately in the same direction (texture).

Opinion on the 2nd polystyrene samples

- Difference in phase-mineralogical composition, indicating the depth of the processes of formation of cement stone
- Features of the morphology of the cement stone as polyhedral crystals composite reinforced with needle and random orientation in space for 1 sample
- Puff micro-structure of cement stone reinforced with needle crystals, relatively textured layers

Heat and mass transfer motion in solar thermal processing polystyrene concrete. Specify concrete structure more suited to the capillary-porous bodies, so well-known classical formula equations governing the laws of heat and mass transfer, can be approximately applied to it. "Exploring the issues of internal moisture transfer, A.V. Lykov proposed mass conductivity equation:

$$qm = - *m*0 \quad (1)$$

Where:
*m = Coefficient of hydraulic conductivity
0 = Potential gradient of moisture transport[78]

"A.V. Lykov, P.D. Lebedev, G.A. Maksimov and V.V. Peregudov showed that the moisture in the material moves through the gradients of temperature and pressure".

"The density of the total flow of moisture qm is the sum of the flux densities of water moving in the material due to these gradients:

$$q_m = -a_m p_o \nabla U \pm a_m \delta p_o \nabla t^o \pm a_p \nabla p \quad (2)$$

where, a_m coefficient of potential conductivity; p_o-density of dry material; *U gradient of moisture content; *to temperature gradient; a_p-transfer coefficient of water due to the pressure gradient; *p = pressure gradient.

"The initial component of the equation $a_m\ p_o$ *U = q_{mu} is the density of the water flow which moves in the materials due to the gradient of moisture content *U. The second term a_m*po*to = q_{mt} is the density of the flow of water to move around in the material due to temperature gradients *t. A.V. Lykov revealed that the presence of temperature gradients over the cross section of the material leads to a movement of water in the material in the direction of heat flow. The third term of the equation ap*p = qmp is the density of the material-moving stream of water due to the pressure gradient * ¬p. Therefore, the expression (2) is expanded in equation internal moisture transfer material.

Expression of external moisture transfer (return moisture from the surface of the material in the surrounding air):

$$q_m = -\gamma_m (P_{\Pi M.} - P_B) \quad (3)$$

Where:

- γ_m = Coefficient of water yielding, the comparison with the difference of withstanding pressures
- $P_{\Pi M.}$ = The partial pressure of water vapor on the surface of the material
- P_B = The partial pressure of water vapor in ambient air [78]

Therefore, having known the equations expressing the laws of heat-portable and mass transfer in capillary movements and porous bodies, for hardening concrete approach but not completely. Laws of heat and mass portable handheld movements in concrete with heat treatment is divided into two parts a heat-portable internal and external heat and mass transfer movement. In this case, when considering the hardening of concrete is the main focus is on external mass transfer movements to the environment because it is linked to the loss of water of the test material into the surrounding phase, especially when solar heat treatment of concrete at high temperatures as well as methods of heat treatment without steam concrete products (e.g., methods of electro-thermal)[21].

Turning to the electro-thermal then heating in a fresh concrete at a rate of over 200 C/h leads to visually noticeable defects in the form of specific cracks which quantity as one approaches the surface of non-cover increases. "With the quickening speed of warming temperatures, structural deformations appear clearer and are at high rate of temperature increase of >80°C/h or more to buckle exposed concrete surface and the formation of defects on it. The use of soft modes of temperature rise of 2-4°C/h leads to a sharp decrease in temperature gradients over the cross section design that eliminates moisture migration and increased porosity of the concrete[5]. When electro-thermal raise the temperature by >80°C inappropriate because it may in some cases lead to insufficient strength in the design of concrete as well as excessive loss of moisture. At temperatures above 60°C and increased evaporation of water in the inner capillary-pore system, leading to a significant increase of vapor content in the material, increasing the internal pressure due to a loosening of the concrete and reduction of its density and strength. With the dramatic impact of the energy, the unevenness of the temperature field in the warmed special designs of high-rise buildings up to 80°C. At the same time, at low speeds, increase in temperature, such as in this case, in concrete warming by solar radiation, the temperature difference does not exceed 14-16°C. Allowable temperature gradients up 0.15°C/cm which guarantee avoiding cracking of massive structures.

Too large temperature gradients contribute not only to non-uniform hardening of concrete and acquisition of material in the heat treatment of insufficient strength but also cause thermal stress in which a material may have micro-cracks as well as visually apparent cracks. Experiments done by the author revealed that the temperature gradients are gaining higher limits during the temperature increase and approaches 0°C during isothermal interval. When a contact heating plate in a thickness of 50 mm for 1 hour after heating temperature gradients become °C 3.4/cm, 3 h later, these gradients are scored 1.6°C/cm. During the heat treatment step is a need to achieve that temperature gradients and gradients were low moisture or in the best case, much lower than the limit, degradation of the material when it is possible. Strength of the structure of the molded fresh concrete depends on limiting gradients at the time when the heat starts, high temperatures and other factors and can be determined by the experimental procedure.

Analyze this investigation gives reason to believe that the traditional methods of treating a warm concrete at high temperatures, temperature gradients are not high and that the maximum allowable rate of increase of temperature does not exceed 20°C and isothermal temperature interval does not exceed 60-80°C. Identified temperature regimes is desirable to connect with solar thermal processing for the production of high quality concrete. Regulation solar thermal processing polystyrene through solar systems with intermediate heat carrier.

Heat treatment: The duration of this stage of the redistribution, high-temperature processing and system settings with intermediate heat carrier to ensure the accelerated hardening of concrete at the required properties and durability of it in the hardened state.

Heat treatment in most cases reduces the value of the physic-technical properties compared to the concrete hardening in the environment under normal conditions. Moreover, this reduction is greater, with more stringent conditions of heat treatment applied. It was therefore necessary to choose the soft experimental conditions of heat treatment product carried out with t = 39-400S helio-forms with increase in temperature in the material to 60-700S within 4-6 h, isothermal conventional ripening 5-7 h and cooling rate 1.2-2.0°C/35 h-500S. Consider one of the most interesting methods of solar concrete products with the application of film-forming substances. It warms up fresh concrete under the action of solar radiation with significant participation in the process of cement exo-therm and then maintains thermos products in various ways solar heat treatment to ensure receipt of concrete at the age of 1 day projected strength. Analysis of the research shows that the main trend of solar energy heat treatment of concrete, until recently was the development of heat and humidity treatment helio-camera for concrete, recommends the use of a variety of polymeric film materials. Explore ways that are the most streamlined and easy to use, it is also a significant advantage in the fact that in helio-camera can and should be put fresh molded products immediately after they finish, that is, no need for an initial retirement. Terms of aging concrete helio-camera depend on the specific climatic conditions to achieve critical strength required before a moisture loss has a significant impact on the structure of the concrete. For successful use of translucent solar camera of polymeric materials necessary to create them soft modes of solar heat treatment and prevent accelerated mass transfer movement in the environment chamber, through the use of effective film-forming compositions. These authors study was performed in the manufacture of concrete slabs airfield PAG-14 (20 mm) concrete factory class B25 composition. Used Portland cement Shymkent factory brand M400, crushed granite fractions 5-20 mm and silica sand with a fineness modulus equal to 2.73 while the mobility of the concrete mix is 5-6 cm. Molded for 12, immediately after molding and smoothing products are installed chromel-Copel thermocouples connected to Machine-deviceKSP-4. Chromel-Copel thermocouples were installed at a distance of 5, 90, 175 mm from the surface of the product in their geometric center (in the foreground) and in the area of the mounting tabs (within a radius of 7-10 cm). With the evaporation of water from the surface of articles (in an interval of 20-30 min from the completion of molding), film-forming composition was applied using a rod. As a film-forming water dispersion film-forming composition applied composition. Consumption of latex film-forming substance was 200-250 g m^{-2} surface of fresh concrete. Then, the product and the samples were placed in translucent solar camera with intermediate heat carrier which were kept under the sun and on the range 22-24 h. Kinetics of heating and cooling zones of different products at in translucent solar cells with spray latex film-forming composition are given in Table 8 and in Fig. 16. Thermal processing in solar cells with polymer intermediate coolant composition under the film-forming concrete products extends to higher temperatures 56-570S, cooled slowly to 30-250S and maturity of concrete solar thermal processing approximately 10-15% higher than that of concrete, only the heat-treated under a film forming agent *in vivo*.

It is known that most fully manifested in the heat of cement soft warm-up mode. Methods used in practice of intensification concrete hardening and heat exposure modes allow you to use almost no heat of hydration of the binder cement. Since, solar thermal processing in solar cells with a polymer film-forming coating materials implements mild warming modes with concrete, it can be assumed that this method allows using the heat largely by exothermal cement.

Therefore, we can conclude that with the application of solar thermal processing film-forming substance is a new method intensification hardening of concrete products for which the external temperature influence ensures full utilization of the hydration of the binder on the energy-intensive stage of technology heating concrete; in addition, the use of translucent cells prevents excess heat removal from products in the non-solar time.

Thus, the film-forming compositions in conjunction with translucent chamber create favorable regimes that will have a positive impact on the structure and properties of concrete.

Research in heat treatment translucent polystyrene chambers with and without use of an intermediate heat carrier conducted on the materials and formulations shown in Table 7. The heat treatment was carried out on blocks of size 200 h, 300 h, 600 mm.

Industrial use of solar technology and its profitability. Studied the way the consumption of solar energy for accelerated hardening of polystyrene products in the factory show a significant profitability replace traditional fuels to alternative fuels. Studied the new technology compared to the base technology. The choice of the basic process steam heating in steaming chamber compared with the new technology in helio-camera showed high efficiency of the latter.

As a result of research work have been fully addressed in the work assigned task to determine the relationship between the period of solar energy at solar thermal processing growth and strength polystyrene revealed the action flow of incoming solar energy on the nature and temperature fields in alignment with products of polystyrene of different massiveness and surface area. The characteristic structure and the most important quality solar thermal processing polystyrene which are similar to polystyrene concrete by solar thermal processing under normal conditions developed new types of solar technology in translucent cells in combination with film-forming compositions with duplication through solar with intermediate heat carrier. The results of the research have been tested in factories for the production of polystyrene blocks at the stage of treatment with heat solar energy.

CONCLUSION

Thus, the developed heat-treatment method and solar thermal processing method products using film-forming composition makes it possible to save in the hot season in the interval of 200 days a year does not use the traditional steam heating and in the cold season by a combined method can save up to 80-100 kg of fuel equivalent (conventional fuel), about 0,6 t water per m^3 of products and at the same time saving of 1120-1220 tenge m^3 products and provide daily turnover forms. The actual economic impact in the production of 1000 m^3 blocks combined with the use of film-forming and solar thermal processing method composition was 1,223,040 tenge. The presented technology has no analogues in the world.

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