NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN No: 2581 - 4230
VOLUME 7, ISSUE 11, Nov. -2021

NCREASING THE EFFICIENCY OF HELIOTHERMAL TREATMENT OF PRECASTED REINFORCED CONCRETE WITH THE USE OF FLAT REFLECTORS

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ABSTRACT:

Experiments have established the efficiency of using flat reflectors for solar thermal treatment of prefabricated reinforced concrete. It is also substantiated that the use of flat reflectors for 10 months a year can provide at least, and in most cases, a significantly higher intensity of solar radiation of the lower limit of the required maximum intensity of solar radiation of 650 W / m2 to ensure the technological cycle of production.

Keywords: Helio, solar thermal treatment, solar radiation, solar radiation intensity, concrete, reinforced concrete, technological cycle, reflector.

INTRODUCTION:

A very topical issue of the production of prefabricated reinforced concrete products using solar energy at the present time is the lengthening of the period of solar thermal treatment, without the supply of additional traditional energy. Using the energy of solar radiation from the natural flow for heat treatment of concrete of precast concrete products and structures using various technologies, incl. SVITAPovskaya, with the use of heat-accumulating and heat-insulating solar chambers, accumulating pallets and arrays, etc., makes it possible to provide a daily technological production cycle for 5-7 months a year, with restrictions on the start time of solar thermal treatment during the day and in thickness manufactured products [1].

In our opinion, the solution of the problem of lengthening the period of solar thermal treatment of prefabricated reinforced concrete during the year, increasing the intensity of the radiation flux with the help of flat reflectors, without consuming traditional heat carriers, removing restrictions during solar thermal treatment in terms of the time of its beginning during the day and in thickness products.

The first studies of the study of the effectiveness of the use of flat reflectors to accelerate the hardening of heliotreated concrete were carried out at NIIZhB. The results of experiments carried out on models made of hardened concrete showed the feasibility of finding ways and a method of using reflectors for solar thermal treatment of concrete with the use of SVITAP coatings. Since the experiments aimed at studying the kinetics of concrete heating have shown that both in the rate of concrete heating and in the daily heat content, the heating mode under SWITAP with the use of flat reflectors on a clear sunny winter day approaches the spring - summer (Fig. 1), and at using a reflector on a hot summer day, the increase in the heat content of concrete already at the heating stage is 10-15%.

Fig. 1. Dependence of the heating of the central zones of hardened concrete samples with dimensions 15x15x15 cm under SWITAP when using flat reflectors during the day.

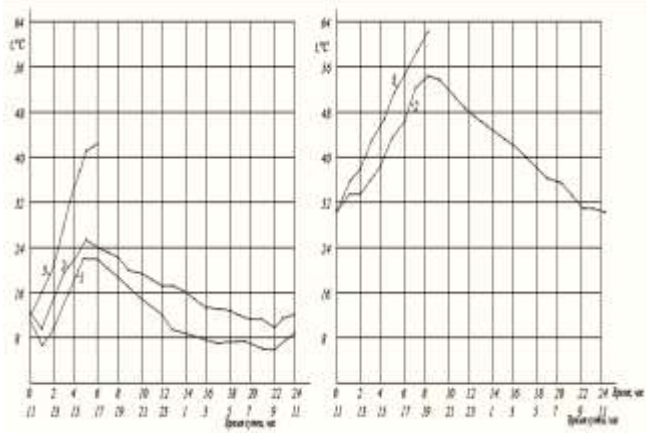


Fig. 1. Dependence of the heating of the central zones of hardened concrete samples with dimensions 15x15x15 cm under SWITAP when using flat reflectors during the day.
1-heating of open concrete;
2-heating under the PVC-based SWITAP (B);
3 - the same, using a flat reflector;
a - in January; b - in July.

As noted above, the experiments were carried out on hardened concrete, where there is no energy release from cement hydration, in addition, hardened concrete has a solar absorption coefficient of 30-40% less than fresh concrete. And the establishment of the optimal angles of inclination and the material of the reflector could increase the efficiency of solar thermal treatment of concrete using flat reflectors. To substantiate the expediency of using flat reflectors for solar thermal treatment of concrete, as well as to resolve the questions posed, we carried out a number of experiments.

The experiments were carried out in natural conditions in the city of Bukhara. The change in the heating of concrete was established using a KSP-4 potentiometer and XK-thermocouples, by heating standard with an edge 15 cm and representative from the position of heating samples, 40x40x15 cm in size, placed in a solar chamber. The strength of concrete was determined on samples 15x15x15 cm. In the experiments, concrete was used with a composition of 1: 2.82: 3.39 with the following components: Navoi Portland cement M400, granite gravel F_r = 5-20mm, quartz sand M_{cr} = 2.34.

The results of experiments carried out in October with the beginning of solar thermal treatment at 800 hours are shown in Fig. 2. and table -1.

It follows from the figure that the rise in the temperature of the middle zones of the concrete of the samples during solar heating occurs when the reflector is used at a rate of 6-7 ° C / hour, and in its absence, 2.5-3 ° C / hour, and cooling in both cases at a rate of 1 -1.5 ° C / hour. An increase in the intensity of solar radiation from the use of a reflector by 375 W / m2 at its maximum ensured, despite low ambient temperatures (14-15 ° C), heating of concrete to 63 ° C, which in the case being compared is only 42 ° WITH.

The results presented in Table 1 indicate an increase in the total intake of solar radiation during the day on the surface of the heliopathing by 70% from the use of a flat reflector, an increase in the daily maturity of concrete samples by 32%, an increase in daily strength by 37%, as a result of which the achievement of standard samples by concrete in a daily aged compressive strength 53% R_{28}.

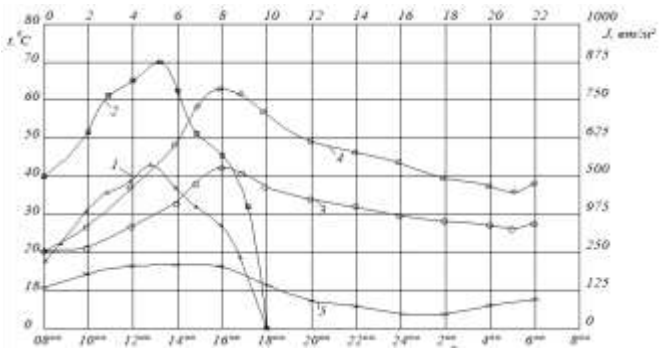


Fig. 2. Heating up concrete using flat reflectors.
1- natural intensity of solar radiation;
2-intensity of solar radiation using a flat reflector; 3-temperature of the middle zones of the concrete sample without the use of a flat

reflector; 4 - the same with a flat reflector; 5- ambient temperature.

A statistical analysis of the results of laboratory and industrial research in natural conditions showed that with effective thermal insulation of the sides and pallet of metal fittings of forms, the intensity of solar radiation in 600-650 W / m², at its maximum during the day, ensures that concrete products achieve a strength of 45 - 55% R_{28}, quite sufficient for stripping a number of products and structures and the daily turnover of forms.

Table 1. Daily maturity and strength of concrete during solar thermal treatment using flat reflectors

Start of heliothermal treatment within 24 hours	Total intensity of solar radiation during the day, W / m2		Daily maturity concrete S, degree x hour		R_{sg} aged 1 day, MPa		R_{28}, MPa
	Without the use of a flat reflector	With the use of a flat reflector	Without the use of a flat reflector	With the use of a flat reflector	Without the use of a flat reflector	With the use of a flat reflector	
8^{00}	3800	6486 170	667	884 132,5	7,35 39	10,1 53,2	18,8

Note: 1. in columns 3.5 in the numerator there are absolute values, in the denominator there is an increase relative to the corresponding ones without a reflector;

2. in columns 6.7 in the numerator the absolute values, in the denominator% of R_{28}.

To establish the efficiency of using reflectors throughout the year, i.e. to determine the actual intensity of solar radiation on the surface of the heliopathing both in the natural flow and additionally in the one reflected from flat reflectors on the 10th, 20th, 30th of each month of the year, at 1300 o'clock in the afternoon we carried out measurements using an albedometer with a portable galvanometer (Fig.3).

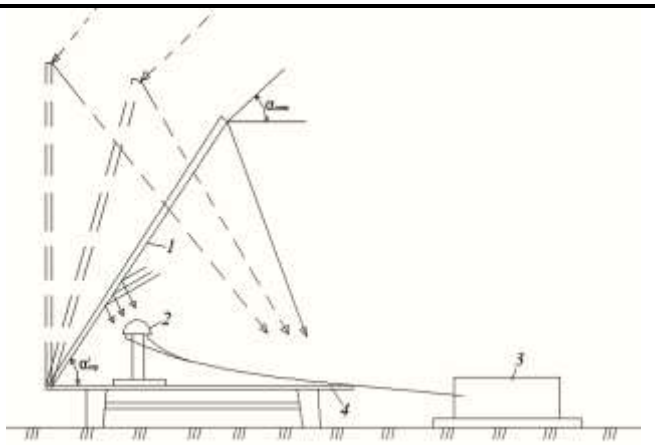
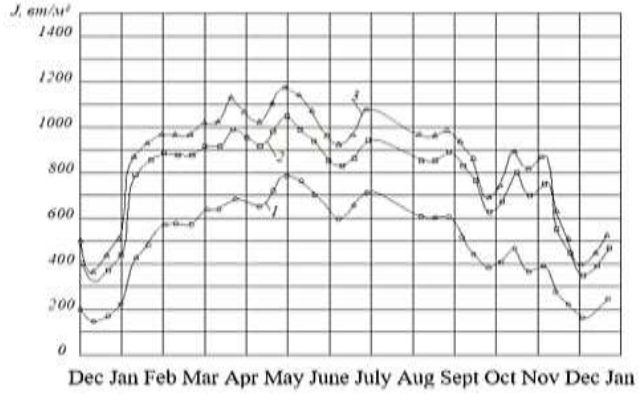


Fig. 3. Scheme for measuring the intensity of solar radiation 1 - flat reflector; 2 - albedometer; 3 - portable galvanometer.

The results shown in Fig. 4 indicate that, along with an increase in the intensity of the radiation flux when using a flat reflector by 28-112% in different months of the year, with the adoption of the lower limit of the required maximum intensity of solar radiation of 650 W / m² to ensure the technological cycle of production, the use of flat reflectors allows 10 months to provide not less, and in most cases, and a significantly greater intensity of solar radiation [2].



Rice. 4. The intensity of solar radiation throughout the year.

1 - natural density;

2 - when using a flat reflector;

3- at its maximum reflection from the reflector on the surface of the solar cover.

Thus, the expediency of using flat reflectors has been established, which contribute to an increase in solar radiation falling on the surface

of the heliopathing during the heliothermal treatment of concrete.

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