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Annotation. The article discusses the use of solar receivers by the definition ofSTST based on the absorption capacity of α_{ST} samples by solar radiation. The scheme for determining the aS and the main parameters of the problem are analyzed in the figures as tables.

Keywords: balance equation, radiation source, sample heating, calculated curves, emissivity, cooling dynamics, incident radiation flux.

As is known, the absorbance aST is a function not only of the spectral characteristics of the material itself, but also of the temperature of the radiation source. Therefore, for solar receivers, the determination of aST must be carried out either directly when the sample is irradiated with solar radiation, or with a radiation source with a temperature close to the temperature of the Sun (for example, xenon ball lamps).

Let us consider the problem of determining αS from the determination of eT from the equilibrium temperature developed in [1]. In this case, it should be taken into account that the condition α1 = e1 and α2 = e2 in general is not satisfied, i.e. αS is not equal to eT.

In this regard, the form of the balance equation changes. The scheme of the task of determining aST and the parameters of the task are shown in Fig.1.

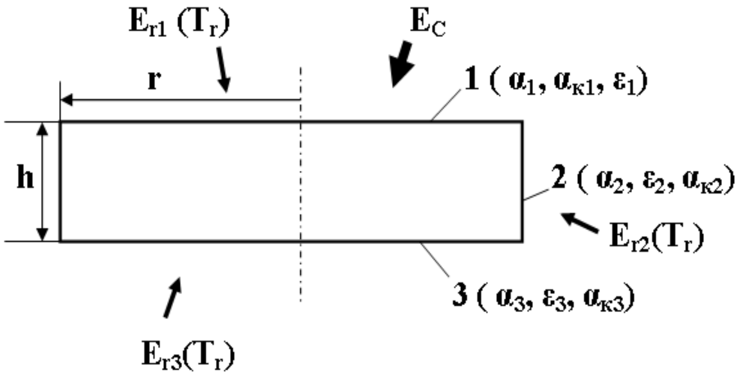


Fig.1. Scheme for determining αS and the main parameters of the problem.

Let us consider the general balance equation of the plate, taking into account the fluxes incident not only on the front (1), but also on the side (2) and back (3) sides of the plate.

$$F_1 * E_{ПОГЛ1} + F_2 * E_{ПОГЛ2} + F_3 * E_{ПОГЛ3} = F_1 * E_{ИЗЛ1} + F_2 * E_{ИЗЛ2} + F_3 * E_{ИЗЛ3} + $$
$$+F_1 * E_{K1} + F_2 * E_{K2} + F_3 * E_{K3} \qquad (1)$$

where F_1, F_2, F_3 – plate surface areas, absorbed radiation densities are equal to

$$E_{ПОГЛ1} = \alpha_S E_C + \varepsilon_{T1} * E_R$$
$$E_{ПОГЛ2} = \varepsilon_{T2} * E_R \qquad (2)$$
$$E_{ПОГЛ3} = \varepsilon_{T3} * E_R$$

and the densities of convective flows

$$E_{K1} = \alpha_{K1} * (T - T_B)$$
$$E_{K2} = \alpha_{K2} * (T - T_B) \qquad (3)$$
$$E_{K3} = \alpha_{K3} * (T - T_B)$$

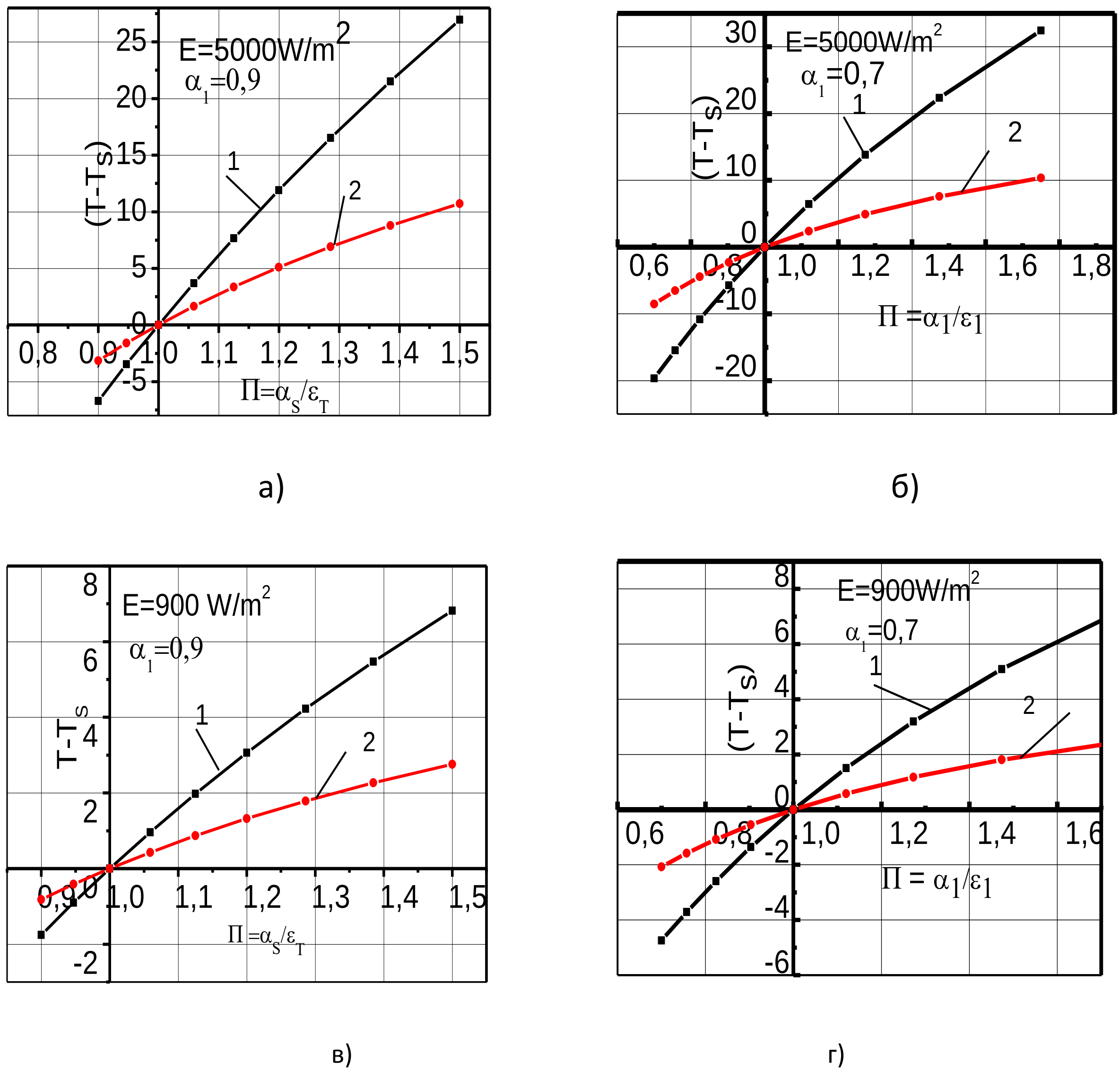
where α_K – coefficients of convective heat transfer.

Solving equation (1) with respect $\alpha_S / \varepsilon_{T1}$ taking into account (2) and (3), as well as taking into account. $F_1 = F_3$ and assuming that the temperature of the plate on all surfaces is the same and equal to T, we obtain

$$\alpha_S / \varepsilon_{T1} = [\sigma T^4 * [(\varepsilon_{T1} + (F_2/F_1) * \varepsilon_{T2} + \varepsilon_{T3}] + (T - T_B) * [\alpha_{K1} + (F_2/F_1) * \alpha_{K2} + \alpha_{K3}] -$$
$$- E_R * (\varepsilon_{T1} + (F_2/F_1) * \varepsilon_{T2} + \varepsilon_{T3})]/(\varepsilon_{T1} * E_C) \qquad (4)$$

Expression (4) takes into account that different plate surfaces can have different radiation characteristics and different convective heat transfer coefficients.

As can be seen, the error of this method will be the same as in the methods developed above, and it is desirable to measure EC after reaching the equilibrium temperature of the sample.



1 - all surfaces have the same working

α_S и ε_T и 2 - surfaces 2 (side) and 3 (back) are blackened

Fig.2. Effect of selectivity on equilibrium heating temperatures at

E_C=5000 Вт/м^2 (а,б) и E_C=900 Вт/м^2 (в,г) для α_S = 0,7 и α_S = 0,9.

It can be noted that the case P > 1 corresponds to "heating" surfaces (heating temperatures are higher than for gray bodies), and the case P < 1 corresponds to "cooling" surfaces (heating temperatures are lower than for gray bodies).

As can be seen, the selectivity has a significant effect on the equilibrium temperature. So already at a selectivity of about 1.2 and EC = 800–900 W/m2, the temperature difference exceeds 1 deg., and at EC = 5000 W/m2, the temperature difference reaches 7–10 degrees. Thus, it is desirable to measure αS at high equilibrium temperatures (not exceeding the operating temperatures of the surfaces) and, accordingly, at high solar radiation densities.

Methods for determining the radiation characteristics of opaque materials by the reflection coefficient are among the simplest in terms of methodology.

Reflectivity is determined by the ratio of the reflected flux to the incident.

$$\rho = E_{ОТР}/E_{ПАД} \quad (5)$$

Since real materials can have a sufficiently large diffuse reflection component, the main condition for applying this method is to ensure that the receiver intercepts the entire reflected stream. For this, photometric spheres or integrating spheres are used, and their “feature” is that the signals at the receiver are significantly small and, as a result, the implementation of the method requires a fairly large amount of preliminary work to eliminate errors [2]. For selective receivers of solar radiation, let's consider another scheme for implementing the method - measuring the reflected flux with a photoelectric receiver of sufficiently large dimensions, see Fig.3. The possibility of using such a scheme is due to the fact that a large absorption of solar radiation up to 3 μm is important in solar receivers, i.e., it can be assumed that in the sensitivity region of the photocell (up to 1.1 μm), the absorbance of the selective receiver will be close to its average value in wavelengths up to 3 μm. It should be noted that the threshold values of wavelengths for the TPU lie in the region up to 2 μm, i.e., this express method will be more suitable for high temperature receivers.

The error of this method is determined mainly by the incompleteness of the interception of the flow, which is equal to 10% in the limit, in reality it will be less due to the fact that in practice for real materials the difference between the normal and hemispherical reflection coefficients is generally small [2], i.e. the main part of the reflected flux lies in a relatively small solid angle, and also due to the fact that the flux reflected from the sample to the receiver hole can be taken into account. The advantage of the proposed express method is its simplicity and relative speed.

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