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Flat From the Reflector Returner the Sun Integrated Reflection of Radiation Carry on Coefficient Count Method

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ABSTRACT: The article presents the theoretical foundations of the method of calculating the integral reflection coefficient of solar radiation returning from a flat reflector installed parallel to the back of the waste reactor of the solar device in order to ensure the temperature regime required for the thermal processing of solid household waste. Taking into account the multiple reflection of radiation from the interface between two media, a calculation scheme for determining the integral reflection coefficient of the considered type of flat reflector is presented, and based on this scheme, direct from the flat reflector of the solar device for thermal treatment of household solid waste is presented. -expressions for determining the integral reflection coefficient of direct solar radiation are given.

KEYWORDS: solar energy, flat reflector, integral reflection coefficient, thermal treatment of household solid waste, direct solar radiation.

I.INTRODUCTION

The article presents the theoretical foundations of the method of calculating the integral reflection coefficient of solar radiation returning from a flat reflector installed parallel to the back of the waste reactor of the solar device in order to ensure the temperature regime required for the thermal processing of solid household waste.

Taking into account the multiple reflection of radiation from the interface between two media, a calculation scheme for determining the integral reflection coefficient of the considered type of flat reflector is presented, and based on this scheme, directly from the flat reflector of the solar device for thermal treatment of solid household waste is presented. -expressions for determining the integral reflection coefficient of direct solar radiation are given.

The density of the solar energy flux falling on the flat reflector of the solar device for the thermal processing of household solid waste depends not only on the density of the solar radiation flux, but also on the angle between the flat reflector and the Sun. If the absorbing surface of the flat reflector and the solar radiation are perpendicular to each other, the radiation flux density is maximum [1,4].

In order to increase the energy efficiency of the flat reflector solar air heating collector with heat accumulator (FRSAHCHA), flat reflectors are installed parallel to the light receiving surfaces from its two sides. Flat reflectors increase the density of the solar radiation flux falling on the FRSAHCHA light-receiving surface, which leads to an increase in their efficiency. Usually, the reflector FRSAHCHA's light acceptance to do surface with one different to dimensions have.

II.MATERIALS AND METHODS

In Duffie JF, Beckman WA [1]. radiation heat transmission flow from algebra used without flat of reflectors share count method available [2] of FRSAHCHA energy indicators right evaluation for not only coming down the sun of energy common power, ground albedo and of the area meteorological taking into account the characteristics get need.

The reflection coefficient is a dimensionless physical quantity that describes the ability of an object to reflect incident radiation.

In cases where the spectrum of solar radiation is narrow in the process taking place, it can be considered monochromatic or monochromatic reflection coefficient. If the spectrum of solar radiation falling on the body is wide, then the corresponding reflection coefficient is sometimes called integral.

In general, the value of the reflection coefficient of the body also depends on the specific properties of the body, the angle of incidence of solar radiation, the spectral composition and polarization. Due to the dependence of the reflection coefficient of the surface of the object on the wavelength of the light falling on it, the object is visually perceived as painted in one or another color.

Specular (directional) reflection irregularities occur when radiation falls on a surface that is much smaller than the wavelength of the radiation.

In practice, the integral reflection coefficient is calculated as the ratio of the sum of the ordinates obtained after 10 or 20 nm for the curves describing the spectral composition of the reflected and incident light fluxes [1-11].

Solar reflectors can be made with front and back metal reflective layers.

A mirror is a smooth surface designed to reflect light (or other radiation). The most obvious example is a flat mirror.

To protect the surface of flat reflectors from the abrasive effect of atmospheric particles and periodically clean, various weather-resistant high-transparent varnishes [2] and SiO_1 SiO_2 and TiO_2 oxides are applied by hot evaporation and spraying in atmospheric air. is used [3]. Flat reflectors of the considered type have a very high integral reflection coefficient of direct solar radiation, which is close to the reflection coefficient of the metal layer.

The problem of protecting the reflective surface of the reflectors can also be solved by applying the method of back laying of the reflective layer. In such radiation reflectors, glass with a high transparent layer of 2÷4 mm thickness is used as a transparent protective coating of the metal reflecting layer. A thin reflective metal layer is deposited on its back by spraying. The metal reflective layer is covered with a special compound to protect it from various mechanical and atmospheric influences. Due to the absorption of solar radiation by the transparent coating, the reflection coefficient of solar radiation of this type of reflectors is slightly lower than that of previous reflective layer reflectors.

It is of interest to determine the integral reflection coefficient of direct solar radiation of a flat glass reflector with a back metal reflective layer.

The calculation scheme for determining the integral reflection coefficient of a flat reflector of the considered type, taking into account the multiple reflection of solar radiation from the interface between two media [4] is shown in Fig. 1.

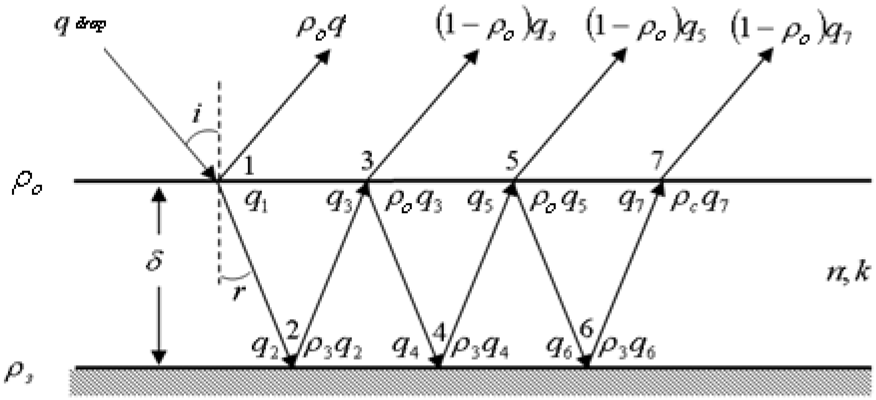

Figure 1. Balance equation for incident, reflected and refracted radiation for a flat reflector with a metal back reflective layer.

where, ρ_c and $\rho_з$ are the reflection coefficients of the transparent protective and metallic reflective layers, respectively; i and r - respectively, the angles of incidence and refraction of direct solar radiation; δ - the thickness of the transparent protective layer n - the index of refraction of the transparent protective layer of the correct solar radiation; k - the coefficient of attenuation of direct solar radiation transmitted to the material of the transparent protective layer.

III. RESULTS

According to Figure 1, the flow of direct solar radiation (q_{ref}^{rad}) falls on point 1 in the plane of the front surface of the protective glass of the reflector. The energy of this current is calculated based on the following equation.

$$q_{ref}^{rad} = \rho_o q_{ref}^{rad} \tag{1}$$

is reflected from the protective glass surface of the flat reflector, and the other part passes through the air-glass interface according to the following expression (2).

$$q_1 = q_{rad}^{dir} - q_{ref}^{dir} = (1-\rho_o) q_{rad}^{dir} \tag{2}$$

Point 2 in the plane of the back surface of the protective glass of a flat reflector is equal to the direct solar radiation flux.

$$q_2 = q_1 e^{-\frac{k\delta}{\cos r}}, \tag{3}$$

from that $\rho_3 q_2$ metal reflection bringer layer on the surface equal to part back reflection is enough

Flat at point 3 of the reflector protection the front surface of the window to the plane equal to right the sun radiation flow will come

$$q_3 = \rho_3 q_2 e^{-\frac{k\delta}{\cos r}}. \tag{4}$$

This of flow one part of $\rho_o q_3$ to equal protection window inside reflection will be made , one part and glass is air interface through pass , that is :

$$q_3 - \rho_c q_3 = (1-\rho_o) q_3, \tag{5}$$

Just like that So, we have glass- air at points 5 and 7 interface through passable right the sun radiation of streams values let's find out .

Back reflection bringer layered flat from the reflector reflection delivered right the sun of the integral flow of radiation expression according to Fig. 1 the following in the form of expression can :

$$q_{ref}^{dir} = \rho_o q_{rad}^{dir} + (1-\rho_o) q_3 + (1-\rho_o) q_5 + (1-\rho_o) q_7 + ... = \rho_o q_{rad}^{dir} + (1-\rho_o)(q_3 + q_5 + q_7 + ...). \tag{6}$$

Values (6) q_3, q_5, q_7 to the scheme of Fig. 1 according to from expressions the following is determined .

$$q_3 = \rho_3 q_2 e^{-\frac{k\delta}{\cos r}}; \tag{7}$$

$$q_5 = \rho_3 q_4 e^{-\frac{k\delta}{\cos r}}; \tag{8}$$

$$q_7 = \rho_3 q_6 e^{-\frac{k\delta}{\cos r}}; \tag{9}$$

$$q_n = \rho_3 q_{n-1} e^{-\frac{k\delta}{\cos r}}. \tag{10}$$

in (7). q_2 value (2) expression with , in (10). $q_4, q_6, ...q_{n-1}$ values while own in turn the following from expressions defined as :

$$q_4 = \rho_o q_3 e^{-\frac{k\delta}{\cos r}}; \tag{11}$$

$$q_6 = \rho_o q_5 e^{-\frac{k\delta}{\cos r}}; \tag{12}$$

$$q_{n-1} = \rho_o q_{n-2} e^{-\frac{k\delta}{\cos r}}. \tag{13}$$

Expressions (7) - (10). according to $q_3, q_5, q_7 ....q_n$ of value to (6) . replacing expressions (11) - (13). according to $q_4, q_6, ...q_{n-1}$ of value suitable respectively account if we take the following the equation harvest we do:

$$\sum q_{ref}^{dir} = \left[\rho_o + \rho_3(1-\rho_o)^2 e^{-\frac{2kd}{\cos r}}\left(1+\rho_3\rho_o e^{-\frac{2kd}{\cos r}} + \rho_3^2\rho_o^2 e^{-\frac{4kd}{\cos r}} + ...\right)\right] q_{rad}^{dir} . \quad (14)$$

That’s it relationship with,

$$1+\rho_3\rho_o e^{-\frac{2kd}{\cos r}} + \rho_3^2\rho_o^2 e^{-\frac{4kd}{\cos r}} + ... = \sum_{i=0}^{\infty}\left(\rho_3\rho_o e^{-\frac{2kd}{\cos r}}\right)^n , \quad (15)$$

Expression (14). as follows writing possible

$$\sum q_{ref}^{dir} = \left[\rho_o + \rho_3(1-\rho_o)^2 e^{-\frac{2kd}{\cos r}} \sum_{i=0}^{\infty}\left(\rho_3\rho_o e^{-\frac{2kd}{\cos r}}\right)^n\right] q_{rad}^{dir} . \quad (16)$$

If this expression account if we get the following equation harvest will be:

$$\sum_{i=0}^{\infty}\left(\rho_3\rho_o e^{-\frac{2kd}{\cos r}}\right)^n = \frac{1}{1-\rho_3\rho_o e^{-\frac{2kd}{\cos r}}} , \quad (17)$$

she is expression (16) without practical accounts for comfortable in the form our expression can:

$$\sum q_{ref}^{dir} = \left[\rho_o + \frac{\rho_3(1-\rho_o)^2 e^{-\frac{2kd}{\cos r}}}{1-\rho_3\rho_o e^{-\frac{2kd}{\cos r}}}\right] q_{rad}^{dir} . \quad (18)$$

Back reflection bringer layered flat of the reflector right the sun radiation integral reflection on carry on coefficient determination for expression ratio based on done is increased :

$$R_{ref} = \frac{\sum q_{ref}^{dir}}{q_{rad}^{dir}} , \quad (19)$$

to form have though

$$R_{ref} = \rho_o + \frac{\rho_3(1-\rho_o)^2 e^{-\frac{2kd}{\cos r}}}{1-\rho_3\rho_o e^{-\frac{2kd}{\cos r}}} . \quad (20)$$

$R_{ref} = \rho_o + \dfrac{\rho_3(1-\rho_o)^2 e^{-\frac{2kd}{\cos r}}}{1-\rho_3\rho_o e^{-\frac{2kd}{\cos r}}}$ magnitude (20) expression value 1 v (20) value “front transparent protection coating (glass - air)” and “front protection coating - metal reflection bringer layer” parts on the borders the sun of radiation repeated reflection reach because of back reflection bringer layered flat of the reflector right the sun integrated reflection of radiation carry on of the coefficient relative growth account takes.

IV.CONCLUSION

In order to ensure the temperature regime necessary for heliothermic processing of waste in a solar device for the thermal treatment of solid household waste, the efficiency of the flat reflector solar air heating device with a heat accumulator on the side and bottom of the waste reactor is the density of the solar energy flow falling on the flat reflector-solar radiation also depends on the flux density and the angle between the flat reflector and the Sun. A flat reflector increases the efficiency of a solar air heater from 45÷60 percent to 55÷65 percent.

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