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Processes of Operation of Passive and Active Circulation Solar Water Heaters

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Abstract: *In this article addition to the efficiency of solar water heaters and the ability to provide heat, this article presents issues of determining the processes of heat exchange depending on the number of Nusselt numberand proposes novel approaches.*

Keywords: *Solar energy, heating systems, building, absorber, Solar water heater.*

Introduction.

In this case consider the case when the system of collectors, water thank and connecting pipe conductors is filled with cold water. Solar radiation passes through a transparent coating (glass) and heats the Collector's light-absorbing panel and the water in its channels. In the process of heating, the density of water decreases, the heated liquid begins to flow to the high point of the collector, and then moves along the pipe to the water thank. In buck, the heated water moves to the upper point, while cooler water settles in the lower part of the buck, that is, depending on the temperature, the separation of water into layers occurs.

Cold water moves along the pipe from the bottom of the tank to the bottom of the Collector. Thus, in the presence of sufficient solar radiation, a constant circulation is established in the contour of the collector, the speed and intensity of which will depend on the current density of solar radiation.

As a result, the difference in pressures in the system (Δp, *Pa*) the body calls for natural circulation in the solar collector, i.e.

$\Delta p = g \times H \times (\rho_1 - \rho_2)$,

there g = 9,81 m/s2; $N = H_1 - H_2$ (m) – the difference between the upper limit and the lower cold water inlet of the solar collector at the inlet of the heated water in the water thak; ρ_1 and ρ_2-the lower part of the water battery cold water, respectively (T_1) and the density of heated water (T_2) in the water battery.

The difference in how much (T1) and (T2) is high and the value of N is large, the intensity of the natural circulation of water in the device is high.

The peculiarity of such a system is that in the case of a thermosiphon system, it is necessary that the lower point of the water accumulator is no higher than 3-4 m from the upper point of the collector, in the pump circulation, the water thank can be optionally located.

Such a condition is important not only to ensure normal water circulation in the presence of solar radiation during daylight hours, but also to prevent reverse water circulation in the device. These devices are considered very simple in terms of their wide use, exploitation, preparation all over the world, especially in hot climate countries.

In cold climates, it is advisable to use a two-contour scheme of solar water heating collectors, not one-contour. It serves as the main heat carrier heated in the Collector any non-freezing, chemically inactive, (for example, a mixture of water with ethylene or propylene, antifreeze, glycanthine (a mixture of water with glycerin), etc.) liquids.

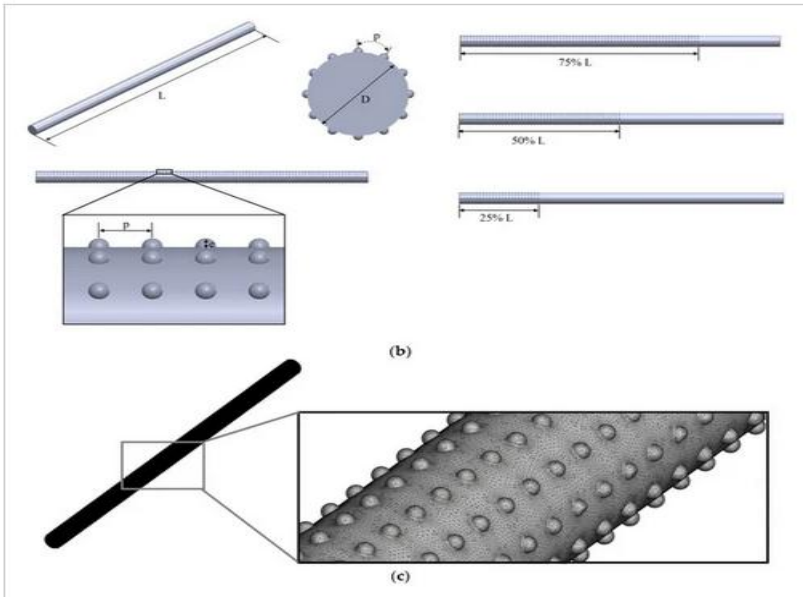

Figure.1. schematic diagram of the computational domain, and (c) meshing–dimple tube.

A two-contour system with a passive circulating heat carrier: the work of such a system is similar to the work of a one-contour system, but the system has a separate berk collector contour in the bakakkmulator, consisting of a heat exchanger, pipe conductors, collectors. This contour is provided by a heat carrier that does not freeze according to a special rule.

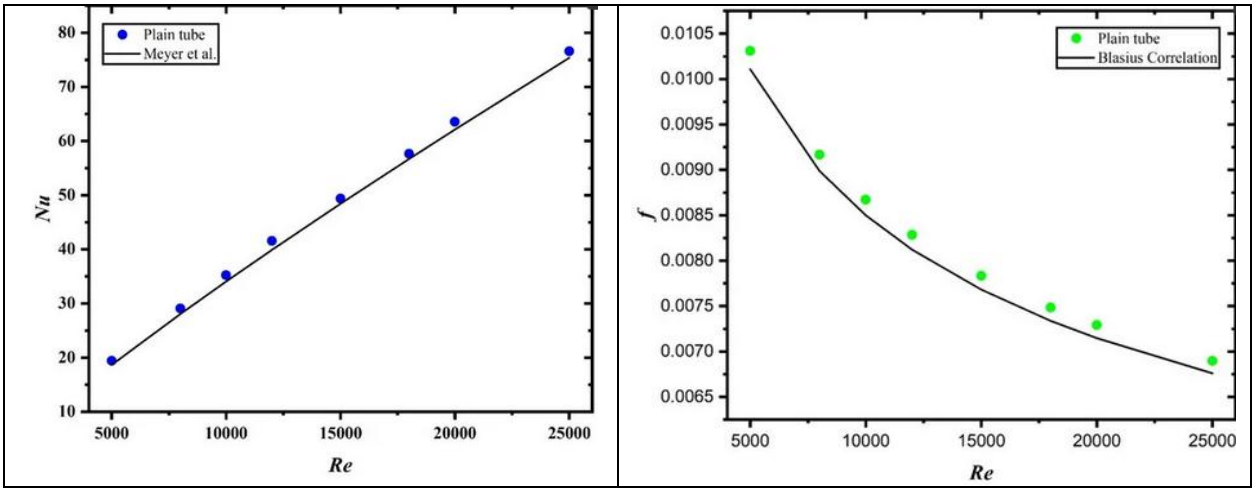

Figure 2. Validation plain tube: Nusselt number.

In the collector, the heat carrier comes to the top of the heat exchanger after heating and transmits its heat to the water located in the buck, then cools and moves down, that is, moving to the inlet of the Collector. In doing so, it performs constant circulation under the influence of solar radiation.

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