METHODS FOR MANUFACTURING SOLAR RADIATION CONCENTRATORS.

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Abstract. In recent decades, power plants based on the conversion of renewable energy sources have significantly expanded their geography, and technologies to increase their efficiency are developing at a faster pace. The conversion of solar energy into heat and electricity is of interest not only for autonomous and remote consumers, but also for owners of solar power plants, which can be used to solve regional energy problems and global energy problems.

Key words: Solar energy, solar radiation concentrators, parabolic surface, photovoltaic converters, electrical efficiency

One of the methods for converting solar energy into electrical energy is the direct conversion method using planar and matrix photoelectric converters. In this regard, the Resolution of the President of the Republic of Uzbekistan dated July 10, 2020 PQ-4779 "On additional measures to increase the energy efficiency of the economy and reduce dependence on fuel and energy products by attracting available resources" puts emphasis on paying broad attention to this development [1].

To create such installations based on solar radiation concentrators, it is necessary to develop a method for calculating the working profile of a concentrator that would provide uniform illumination in the focal region and to choose a method for manufacturing such a solar radiation concentrator [5-8].

The centrifugal method [2] makes it possible to obtain parabolic surfaces using the property of a liquid to acquire a parabolic surface with uniform rotation. Liquids with different specific gravities form equipotential surfaces during uniform rotation, when a lighter material is poured onto a uniformly rotating liquid, which hardens during rotation. After curing, a convex original shape is formed, which has a smooth surface of high purity, formed at the interface of two liquids [9-12].

The Galvano-plastic method [2] makes it possible to manufacture light metal concentrators of solar radiation with high accuracy and almost any size. During the manufacturing process, a conductive silver layer is applied chemically to the matrix, which has the required configuration and a high class of reflective surface cleanliness, on which a metal layer (nickel, copper) is then electrochemically deposited, which has a given thickness. A stiffening frame is attached to the resulting copy, after which it is separated from the matrix [13-15].

The method of glass bending [2] consists in bending sheet glass onto a metal matrix when heated to glass softening temperatures under the action of weight or vacuum. The matrix consists of a plate, on which rack tapes with turntables are installed. Before bending, the platforms are installed according to tangent to the required surface using special templates, after which the oriented platforms are fixed on the racks and the matrix is ready for the bending process. The manufacture of a reflecting surface from flat curved mirrors [2] consists in glass deflection along supports located along its periphery by applying forces in the center of the glass when the deflection value is within the elastic deflection.

Small-precision parabolic concentrators for cooking and water heating are popular among rural people in Asia, Africa and other southern countries. Such concentrators are often made by hand with little precision, but are suitable for cooking and heating water. The base of such concentrators is often made of bamboo, and the reflective surface of reflective aluminum strips. The shape of such concentrators can be faceted, squared in the form of a paraboloid. The payback of such concentrators is often less than one year. Not infrequently, a standard satellite dish, on the surface of which a reflective coating is applied, can be used as a concentrator of solar radiation [16-18].

For the manufacture of solar study concentrators, the main task, along with the manufacturing technology, is the calculation of its working profile, which, when used in conjunction with matrix photoelectric converters, should provide uniform illumination on their surface in order to ensure their maximum electrical efficiency.

Currently existing photovoltaic converters can be classified by the number of p-n junctions - single-junction and multi-junction, as well as by the location of the p-n junction - planar and with vertical p-n junctions. Multi-junction photovoltaic converters include planar - cascade and photovoltaic converters with a vertical p-n junction (matrix photovoltaic converters). In solar energy, when using planar and matrix photoelectric converters, two directions are distinguished - photoelectric conversion of non-concentrated and concentrated solar radiation [22-24]. There are also two directions for reducing the cost of solar photovoltaic stations: improving the technical and economic characteristics of planar photovoltaic converters and creating stations with solar radiation concentrators. The use of concentrating systems makes it possible to reduce the number of photoelectric converters [19-21].

The main features of matrix silicon photovoltaic converters are the possibility of their use at high concentrations of solar radiation, at which an increase in their electrical efficiency is observed [3]. When using such photoelectric converters, it is possible to create a combined installation for the production of electricity and heat. In such thermal photovoltaic systems, the priority task is to remove heat from photovoltaic converters, where the design of solar modules can be both planar [4] and concentrator.

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