SSRG International Journal of Mechanical Engineering Volume 6 Issue 3, 21-25, March 2019
ISSN: 2348 – 8360/doi:10.14445/23488360/IJME-V6I3P104

Improving the Efficiency of Solar Panels by Active Cooling Method using Nano Fluids (Al_2O_3&ZnO)

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Abstract

In our project, the work is to improve the efficiency of the solar panel by nanofluid(Al_2O_3, ZnO) cooling method. A photovoltaic solar cell generates electricity by receiving solar irradiance. The electrical efficiency of the PV cell is affected by a significant increase in cell operating temperature during the absorption of solar radiation. The main objective of the project is to reduce the temperature of the solar panel in order to increase the electrical conversion efficiency. So the need is to decrease the temperature of the solar panel by flowing the nanofluids through the copper tube on the bottom of the solar panel for heat transfer. Already, many of them did the project work with water cooling. But, there is a decrease in the temperature of the solar panel with the help of nanofluids (Aluminium oxide and zinc oxide).

Keyword - *Photovoltaic cell, Nanofluids, Aluminum oxide, Zinc oxide, Electrical conversion, heat transfer.*

I. INTRODUCTION

In our experiment, we are improving the efficiency of the solar panel by the active cooling method so that the temperature of the panel can be reduced, and the elongation of the copper strip can be prevented. By means of heat transfer through convection.

II. PHOTOVOLTAIC EFFECT

The photovoltaic effect is the creation of voltage or electric current in a material upon presentation to light and is a physical and chemical phenomenon. The photovoltaic impact is firmly identified with the photoelectric impact. The photovoltaic impact is a procedure that produces a voltage or electric flow in a photovoltaic cell when it is presented to daylight. This impact makes sun powered boards valuable, as it is the manner by which the cells inside the board convert daylight to electrical vitality.

III. PROBLEM STATEMENT

Due to the variation of the rise in temperature, the copper strip tends to elongate, which distorts the efficiency of the solar panel. In means of various cooling methods, elongation of the copper strip can be prevented. By using direct contact water cooling methods, water tends to evaporate, and the needs for water become more.

So this experiment we are taking of heat by flowing of nanofluids by means of connection between the solar panel and copper tube and the nanofluids can be recirculated and reused.

IV. NANO FLUIDS

Nanofluids are only the nanoscale colloidal suspensions which contain the weakened nanomaterials. There are two-stage frameworks in which one compares to a strong stage, and the other is identified with a fluid stage. Nanofluids have been started to secure the improved thermophysical properties, for example, warm conductivity, warm diffusivity, consistency, and convective warmth exchange coefficients, which were contrasted with those of base liquids like oil or water. It has been built up with extraordinary looming applications in numerous fields. The thought behind the improvement of nanofluids is to utilize them as thermo liquids in warmth exchangers for the upgrade of warmth exchange coefficient and consequently to limit the extent of warmth exchange types of gear. The essential parameters which impact the warmth exchange attributes of nanofluids are its properties, which incorporate warm conductivity, thickness, explicit warmth, and thickness. The thermophysical properties of nanofluids additionally rely upon the working temperature of nanofluids. Subsequently, the precise estimation of subordinate temperature properties of nanofluids is fundamental. Healthy liquids, water, ethylene glycol, and warmth exchange oil plays earth-shattering position in many assembling procedures, for example, control age, warming or cooling forms, substance procedures, and microelectronics. However, these liquids have similarly short warm conductivity, and along these lines can't achieve raised warmth substitute rates in warm building gadgets. A methodology toward ascending above over this solidness in utilizing ultra-fine strong particles adjusted in regular liquids to propel their warm conductivity. The suspension of nano-sized particles (1– 100 nm) in a customary base liquid is known as a nanofluid Nano liquid are the blend of the particle over the liquid with a particle size of microns. Nano flids can't be set up by ordinary mixing strategy. They should be possible just by ultrasonic blending. Ultrasonic blending is the procedure of a complete blend of nanoparticle with liquids by methods for ultrasonic sound waves. Aluminum and zinc oxide is utilized as nano liquids in two cases since they both have high warm conductivity property over them.

V. WORKING

The solar panel, otherwise called a photovoltaic panel, is placed on the sun source. As the solar panel absorbs light source, the heat source will also take part in the atmosphere. This heat affects the efficiency of the solar panel. We have a copper tube set behind the PV panel as a latent heat exchanger. The tube arrangement will have an inlet and outlet port. The inlet port is connected to the pump inside the tank will circulate water or other cooling fluid we pour in the tank. This will control the heat resistance of solar panels.Then the outlet port is connected to the condenser, which is to cool the cooling fluid. Thus the total circuit will be closed circuit. Then the process is continues cyclic.

VI. BLOCK DIAGRAM

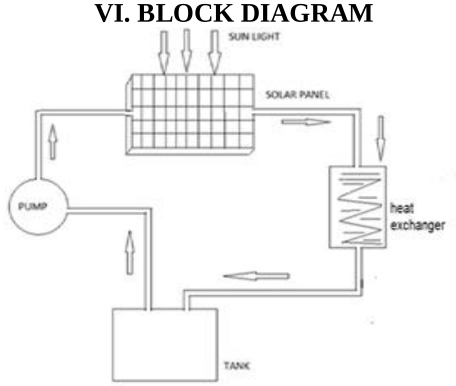

Fig.1 Block diagram

Fig.2 Experimental setup

VII. CONSTRUCTION

Nanofluids Aluminum oxide and zinc oxide are stored in the reservoir tank. The inlet of the reservoir tank is connected to the outlet of the heat exchanger. All the external connections are done by PU tube. 12V DC pump is used for pumping nanofluids from the reservoir tank to the copper tube. 8mm copper tube is used for circulating nanofluids behind the panel. From copper tube, nanofluid is given to the heat exchanger. A heat exchanger is a cooling unit used for cooling nanofluids. Then the nanofluids are given back to the reservoir tank.

VIII. EXPERIMENTAL WORKING

In this process, nanofluids is stored in the tank. Whenever the temperature rises over the critical temperature, the pump tends to turn on. The nanofluids from the tank is pumped to the copper tube seated behind the solar panel. The nanofluids on passing through the copper tube remove the heat from the solar panel it means of heat rejection by means of convection. After taking off heat from the panel, nanofluids comes out through the outlet tube. Nanofluids passed from the outlet of the copper tube is cooled by the heat exchanging unit. After passing through the heat exchanging unit, the nanofluid is reused for cooling purposes.

IX. EXPERIMENTAL READING

We will find the efficiency of a solar panel for three cases.

(a) Experimental setup without cooling.

(b) Experimental setup with cooling by distilled water.

(c) Experimental setup with cooling by nanofluid (aluminum and zinc oxide).

GRAPH

Without cooling

Table 1

Time	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM
Temp	47	51	58	55	52	54
Volt	19.3	18.9	17.6	17.9	18.4	18.2
Amps	1.61	1.52	1.34	1.36	1.32	1.42

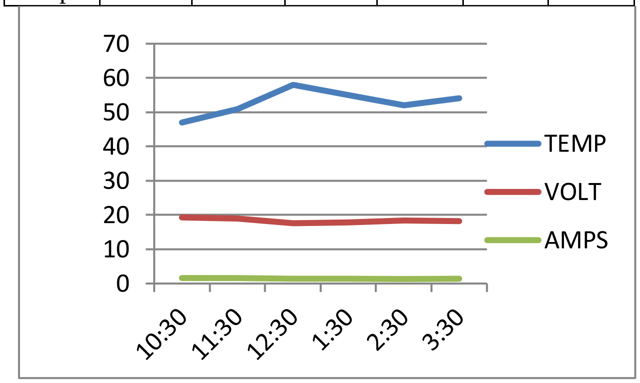

Fig 3: Without cooling

Cooling with Water

Table 2

Time	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM
Temp	48	51	55	55	52	53
Volt	18.2	18.8	20.4	19.6	19.4	19.3
Amps	1.32	1.34	1.94	1.63	1.61	1.58

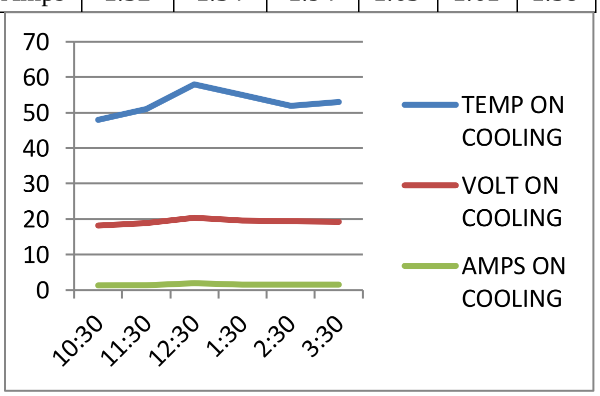

Fig4 Cooling with water

Cooling with Aluminum oxide

Table 3

Time	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM
Temp	45	49	53	50	48	47
Volt	20.3	19.5	18.9	19.2	19.8	19.6
Amps	1.93	1.83	1.72	1.81	1.89	1.91

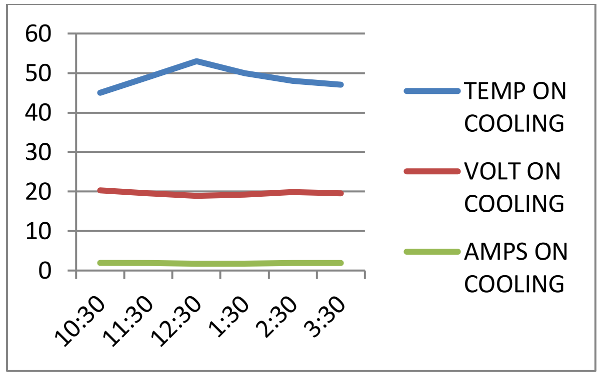

Fig 5 Cooling with Aluminum oxide

Cooling with Zinc oxide

Table 4

Time	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM
Temp	47	50	55	52	50	48
Volt	20.5	18.9	18.2	18.5	19	19.6
Amps	1.94	1.72	1.7	1.73	1.82	1.91

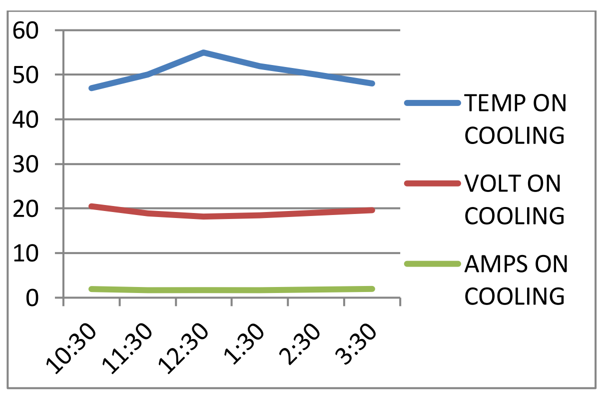

Fig 6 Cooling with zinc oxide

OVERALL READING AND GRAPH

Table 5

TIME	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM
TEMP ON COOLING	45	48	55	52	50	43
VOLT ON COOLING	18.2	18.8	17.9	19.6	19.4	19.3
AMPS ON COOLING	1.32	1.34	1.46	1.63	1.61	1.58
TEMP WITHOUT COOLING	47	51	58	55	52	54
VOLT WITHOUT COOLING	19.3	18.9	17.6	17.9	18.4	18.2
AMPS WITHOUT COOLING	1.61	1.52	1.34	1.36	1.32	1.42
TEMP ON ZINC COOLING	47	50	55	52	50	48
VOLT ON ZINC COOLING	20.5	18.9	18.2	18.5	19	19.6
AMPS ON ZINC COOLING	1.94	1.72	1.6	1.73	1.82	1.91
TEMP ON ALUM COOLING	45	49	53	50	48	47
VOLT ON ALUM COOLING	20.3	19.5	18.9	19.2	19.8	19.6
AMPS ON ALUM COOLING	1.93	1.83	1.72	1.81	1.86	1.91

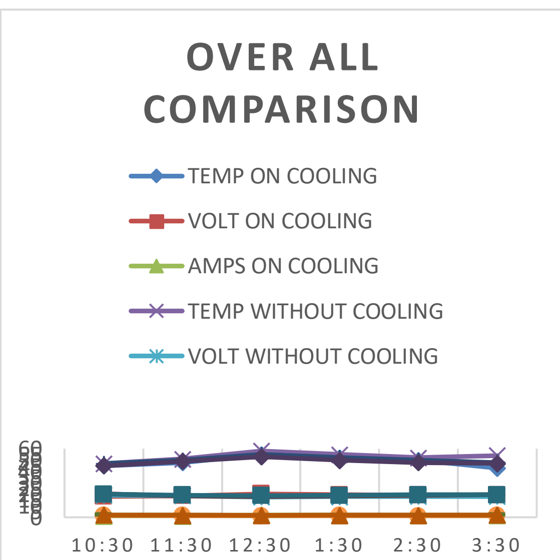

Fig 7 Over all comparison

X. RESULT AND DISCUSSION

From the noted reading for the various condition of fluids such as Aluminum oxide, Zinc oxide, and water. It is noted the value of Volt and Amps for multiple temperature conditions and experimental conditions. The most effective peak time temperature is considered as 12:30 pm, and all the condition is discussed for common peak time.

For without cooling method at the peak time of 12:30 pm temperature value is 58ºC and volt value of 17.6V and amps value of 1.34A.

By using water as a fluid medium, the set of preliminary reading is taken. For water, the temperature value is 55ºC occurs on peak time of 12:30 pm with a maximum volt of 17.9V and maximum amps of 1.46A.

By using aluminum oxide nanofluid for the experiment, the set of readings is taken. For the maximum peak time, the temperature value 53ºC with a maximum volt of 18.9V and a maximum amps value of 1.72A.

By using zinc oxide nanofluid for the experiment, the set of readings is taken. For the maximum peak time, the temperature value 55ºC with a maximum volt of 18.2V and maximum amps value of 1.6A.

XI. CONCLUSION

From the result and discussion, the reading for the various condition of fluids such as Aluminum oxide, Zinc oxide, and water is noted. From this, we observed that a more effective way of heat reduction is done by using different fluid mediums. By the overall comparison, active cooling is obtained by using aluminum oxide is concluded with a maximum volt value of 18.9V and maximum Amps value of 1.72A.

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