Investigation Of Heat Transfer In Natural Convection From Composite Fins By Using Nanoparticles.

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ABSTRACT

The significance of increment in heat transfer rate has achieved greater importance in various field. Heat sink is used to dissipate heat from surface to surrounding. This project has a aim to develop heat sink which have a hear transfer rate than continuous fin. Based on research we developed staggered interrupted with perforated fin. This project has great Importance in increasing heat transfer rate in compact heat exchange, automobile field, electrical transformer and cooling rating turbine and many other application to which will reduce weight and cost and improve its performance. By changing the orientation of rectangular fins we have to design fins like staggered interrupted with perforated fin.The heat transfer from surfaces may in general enhanced by increase heat transfer coefficient between a surface and surrounding, by increase the heat transfer rate. Therefore the aim of the project to increase the heat transfer rate by using nanoparticales.

Keyword : - *Heat Transfer Rate, Composite Material, Interrupted with perforated fin, Nanoparticales etc….*

1. INTRODUCTION

The removal of excessive heat from system components is essential to avoid the damaging effects of burning or overheating. Therefore, the enhancement of heat transfer is an import subject of thermal engineering. The heat transfer from surfaces may in general be enhanced by increasing the heat transfer coefficient between a surface and its surroundings, by increasing the heat transfer area of the surface, or by both. In most cases, the area of heat transfer increased by utilizing extended surfaces in the form of fins attached to walls and surfaces. Extended surfaces (fins) frequently used in heat exchanging devices for the purpose of increasing the heat transfer between a primary surface and the surrounding fluid. The concept of our project is to find out whether the parameters of heat transfer of fin are affected by varying its shape and heat transfer in natural convection from composite material fin by using aluminium and copper oxide as a nanopartical. The project has improve heat transfer re The removal of excessive heat from system components is essential to avoid the damaging effects of burning or overheating. Therefore, the enhancement of heat transfer is an import subject of thermal engineering. The heat transfer from surfaces may in general be enhanced by increasing the heat transfer coefficient between a surface and its surroundings, by increasing the heat transfer area of the surface, or by both. In most cases, the area of heat transfer increased by utilizing extended surfaces in the form of fins attached to walls and surfaces. Extended surfaces (fins) frequently used in heat exchanging devices for the purpose of increasing the heat transfer between a primary surface and the surrounding fluid. The concept of our project is to find out whether the parameters of heat transfer of fin are affected by varying its shape and heat transfer in natural convection rate by using nanoparticals the partical settle rapidly forming a layer on the surface and reducing the heat transfer capacity of the fluid. By using copper oxide as a nanopartical it improve heat transfer rate and also the thermal conductivity rate is high. Fins are of different geometries depending, upon practical applications. They may be of uniform cross sectional area or variable cross section. The concept of our project is to find out whether the parameters of heat transfer of fin are affected by varying its shape. To construct, design and investigation of heat transfer by using different modified fin and also fins should be cost effective and lighter systems.The geometric shapes we chose are rectangular, interrupted, staggered and perforated fins but all are of same surface area. And also by using nanoparticals we improve the heat transfer rate.

1.1 Problem Statement

The heat sink is heated the buoyancy, force causes the surrounding fluid to start moving therefore as a result thermal boundary layers start to devlop at the bottom edges of the fins.The boundary layers mostly merge if the fins are sufficiently long, creating a fully developed channel flow. The extension with perforated fins, therefore, disrupt the thermal boundary layer growth also maintaining a thermally developing flow regime, which can lead ta a higher natural heat transfer coefficient. The increase of heat transfer rate is main purpose in our project.

1.2 Objective

Increase heat transfer rate by varying the shapes of different orientation of fins. Heat transfer rate may be increase by using aluminium with copper oxide as a nanopartical. To reduce the cost of fins and also reduce the weight of fins especially in transformer, airplanes and motorcycles application. To prepare the appropriate experimental setup with an aim to investigate heat transfer using two types of testing plate's namely continuous flat plate and extension with perforation plate along with all the required accessories for the proper functioning of the setup

2. Methodology

A Systematic approach is adopted to study the natural convection heat transfer from the staggered interrupted rectangular, vertically-installed fins. As such, the following methodology has been adopted. The focus of this study is on developing compact easy to use thermal models that can predict the natural convective heat transfer from staggered interrupted, rectangular walls to the ambient. A systematic approach is adopted to study the natural convection heat transfer from the staggered interrupted rectangular, vertically-installed fins. As such, the following methodology has been adopted. The focus of this study is on developing compact easy-to-use thermal models that can predict the natural convective heat transfer from staggered interrupted, rectangular walls to the ambient.

2.1 Litretature Review

P.Moorthy, A.N.Oumer [1] studied and reserched the rectangular fin is best in terms of high heat transfer the plain fin had the least transfer rate performance but high efficiency achieved.The performance increases in plain, wavy and and rectangular orderly. Performance wavi fins 30% and rectangular fin 69%. Rectangular fin produces highest heat transfer performance due to interruption done by the staggered surface to the flow and temoerature boundary layer also the fiow orientation. It was found that rectangular fin has highest heat transfer performance compared to wavy and plain fin. The wavy fin is higher than plain fin.

S.H. Habbbian[2] the three types of fins are used that include that louvered, triangular vortex generator and rectangular vortex generator. The effect of adding copper oxide and aluminium oxide nanoparticles on the heat transfer Improvement of louvered and rectangular vortex generator fins were simulated. The method of heat transfer improvement have been introduced such as using nanoparticles in cooling and their effectiveness have been proved. The CuO and AL2O3 improved thermophysical properties. The thermal properties of nanoparticles are slightly better in composition with Al203. It is highest hear transfer increases.

Kumar Nishant [3] This paper study that the thermal conductivity of nanofluid made of (CuO/water, CuO/EG) and the convective heat transfer of nanofluid made of (CuO/water) nanoparticles.Experiments were carried out in the laminar to the turbulent flow regime. The following conclusions were obtained. It has been found that the thermal conductivity increases with the concentration of nanoparticles, whereas when the temperature also increases the thermal conductivity.

S.Sadrabadi Haghighi [4] An experimental study was performed to measure the heat transfer rate of the plate pin-fin heat sinks under free convection. Based on plate pin-fin a new type of plate cubic pim-fin heat sink mwas designed and manufactured, which is consisted of a plate pin-fib heat sink and some cubical pins perched between plate fins. After that, some experiment were carried out to compare the thermal performance of different types of heat sink. The experimental results exhibited that thermal resistance of plate cjubic pin-fin heatsink was about 12% lower that of a plate pin-fin. Also, as the fin spacing increases, thermal resistance decreases. For studied heat sinks, the heat sink with seven fins and 8.5 mm fin spacing had the lowest thermal resistance and the highest free convection heat transfer rate which can be considered as the optimal design for plate pin heat sink.

Table -1: Physical properties of copper oxide

Thermal conductivity	Bulk density	Purity	Size	Color	Cost	Convective heat transfer coeficient
246	0.79g/cm^3	99%	30-50nm	Black	INR 696 per KGS	240

2.2 Scope

The project has improve heat transfer rate by using nano particles the partical settle rapidely forming a layer on the surface and reducing the transfer capacity the heat transfer capacity of the fluid. By using copper oxide as a nanopartical it improve heat transfer rate also the thermal conductivity rate is high.

3. Expermental Setup

The experimental set up is assembled and all the electrical connections are made. After checking all electrical connections power supply is switched on. The controller on the dimmerstat is operated to increase the voltage supplied to the plate heater from zero to a certain value so that the power input to the plate heater is set as 50 w. The console on the digital voltmeter and ammeter displays the voltage and current supplied from which we can find power input to the heater. The temperature of the plate is continuously monitored until the plate reaches steady state. Temperature of different thermocouples are continuously recorded at a regular interval of 10 min till the steady state is reached. After the steady state is reached,temperaturesof different theromocouples are recorded from the temperature indicator display and power rating from voltmeter and ammeter is recorded. After this the power supplied to heater is changed to 60 w by using dimmerstat and whole procedure repeat again.

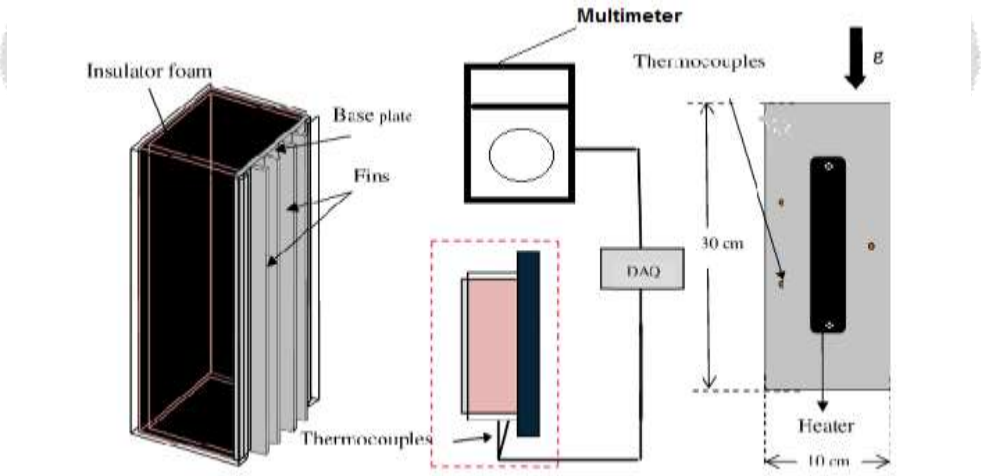

Fig -1: Circuit diagram of experiment setup

3.1 Components of Experimental Setup

Components used for this experiment are as plate, plate heater, voltmeter, Ammeter, Multi-point temperature indicator, Dimmerstat, Insulation material, Thermocouple.

Fig 3.1.1 Continuous Heat sink

Fig 3.1.2 Electric Heater plate

Fig 3.1.3 Dimmerstat

Fig. 3.1.4 Digital Voltmeter and Ammeter

Fig 3.1.5 Thermocouple

The plate is the main component of the experiment The plate material used composite materials. The fin material used copper oxide. The electric plate heater it consist of highly resistive coil of some alloy as nichrome, tungsten etc. The heating element used in Nichrime Wire. The digital voltmeter and ammeter are used to measure voltage and current. The dimmerstst are used to control the output voltage. Thermocouple are widely used to measuring temperatures. Thermocouple are made by joining two dissimilar metals. The range of thermocouple 0*C to 400*C.

4. CONCLUSIONS

The study provides a survey about investigation of thermal performance in natural convection from rectangular extension with perforated fins. As compared to the continuous flat plate, there is marginal rise in the convective transfer coefficient of heat transfer increase with change the orientations. Result in saving material and cost and reduces weight of plate. By using copper oxide as a nanopartical heat transfer rate is high. By increasing heat transfer, this will be very useful in various sectors like transformers, electronic devices, automobiles, etc. The will be useful in various heat sinks and heat exchangers.

5. REFERENCES

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