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HEAT TRANSFER IMPROVEMENT OF CROSS FLOW HEAT EXCHANGER USING HYBRID NANO FLUIDS EXPERIMENTALY

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ABSTRACT

The Requirement and need for a lot of powerful engines in smaller hood areas has created a lower rates heat removation in cross flow heat exchanger (automotive radiators). Upwards of 34% of the energy generated by the engine through combustion is lost in heat. To decrease the stress on the engine as results of heat generation, automotive radiators should be redesigned to be a lot of compact whereas still maintaining high levels of heat transfer performance. Base fluids (water and glycerol) are used as standard coolants in cross flow exchanger device (automobile radiator) for several years; but, these offered low thermal conductivity phenomenon, that has prompted researchers to search out fluids that supply and provide higher thermal conductivity phenomenon compared to it of standard coolants. Nano fluids are thought-about as a new-type heat transfer fluid due to their substantial increase in its heat removal rate, fluids viscosity, and heat transfer coefficient. Planned work concentrates on developing experimental system to analyze the heat transfer rate of cross flow device with hybrid nano fluids as a natural coolant and its CFD Analysis

I. INTRODUCTION

Nano fluids are prepared by combination of nano particles powder in natural heat transfer fluids. thus known as nano fluids. it shows better thermal properties compared with fluids conventionally used for heat transfer and fluids containing particles on the micrometer scale. Nano fluids are the new window that was opened recently and it absolutely was confirmed by many authors that these operating fluid will enhance heat transfer performance. Another application is implementation of nano fluids rather than the standard fluids in cross flow heat exchanger device (radiator).The Cross flow exchanger device is a very important accent of auto engine. The effectiveness of assorted varieties cooling agent within the vehicle cooling system which is able to influence the operation time of the cross flow radiator device (radiator) fan within the lightweight vehicle cooling systems. Cooling system plays necessary roles to regulate the temperature of car's engine. one in all the necessary components within the automotive cooling system is cooling fluid. The usage of wrong cooling fluid will offer negatives impact to the car's engine and shorten engine life. AN economical cooling system will stop engine from excess temperature and assists the vehicle running at its optimum performance. the utilization of a good cooling agent with more cooling performance to boost the cooling potential is that the simplest way for enhancing the warmth dissipation performance.

II. PROBLEM DEFINITION

"Experimental investigation of heat dissipation for cross flow heat exchanger with conventional coolant based hybrid nano fluid its validation with CFD "

Phase-I:-This phase involves the detail study of heat transfer enhancement techniques of cross flow heat exchanger with particular attention towards the passive heat transfer enhancement techniques with nano fluids. Effect of properties related to the nano fluids on heat transfer enhancement will be further analyzed in this phase. Additionally idea behind the mixing of two nanoparticle materials in the base fluid to form the hybrid nano fluids will also be studied.

Phase-II:-On the basis of the concluding remarks from the literature review it is decided to proceed in the same direction towards the investigation of thermal performance the cross flow heat exchanger with hybrid nano fluids. Accordingly the experimental system will be designed and manufactured to investigate the proposed title

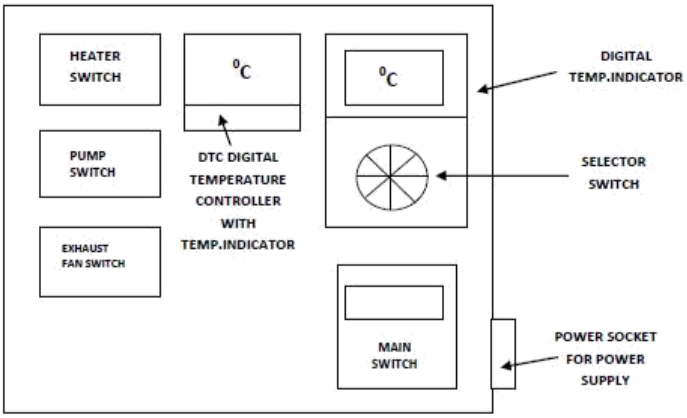

Fig.No.1:-Control panel for proposed experimental system.

Fig. 2 shows the proposed schematic of experimental system and Fig.1 indicates the control panel for experimental system to be developed. The experimental system to be developed includes flow lines, a reservoir tank, heater, a centrifugal pump, flow meter, a forced draft fan, a temperature controller, five RTD's with Six channel temperature indicator to measure the wall temperature and two RTD's with two channel temperature indicator to measure the inlet and outlet fluid temperature in a cross flow heat exchanger.

The test section is a cross flow heat exchanger (an automobile radiator) and forced draft fan. Nano fluid passes through the vertical tubes with stadium-shaped cross section. The fins and the tubes are made with aluminum. For cooling the liquid, a forced draft fan is to be installed close and face to face to the cross flow heat exchanger. Consequently air and water have indirect cross flow contact and there will be heat exchange between hot water flowing in the tube-side and air across the tube bundle.

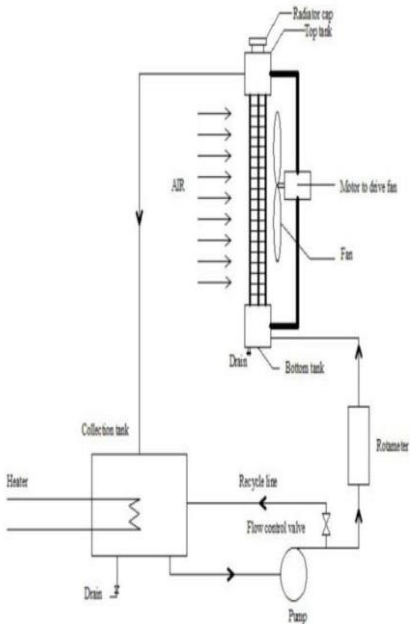

Fig.No.2:- Schematic drawing of the proposed experimental setup.

Phase III:-Additionally to evaluate the accuracy of the measurements, experimental system is to be tested and validated with distilled water before running the experiments with hybrid nano fluids.

Phase IV:-This phase aims to prepare the hybrid nano fluid of required volume concentration with conventional coolant as mentioned. The volume of nano particles to be added in the decided quantity of base fluid will be decided on the basis of volume concentration. The characterization of Nano fluid will also be done in this phase only. **Hybrid Nano fluid preparation:-**Hybrid Nano fluid is to be prepared with following specification

Nanofluid Number	**Nanoparticles material**	**Base fluid**	**Nanoparticles size**	**Variation in concentration of Hybrid Nano fluid by volume fraction %**
I	$ZnO + Fe_2O_3$	Manufacturer recommended coolant (Green colour)	60/60 nm	0.5
II	$ZnO + Fe_2O_3$			1.0
III	$ZnO + Fe_2O_3$			1.5

Phase V:-By using the hybrid Nano fluid prepared in the above phase, experimentation will be carried out on proposed system with variation in inlet temperature, flow rate and volume concentration of Nano fluid. The corresponding observations will be noted in the respective conditions which will be further utilized to draw conclusions.

Phase VI:-In this phase the effect of the parameters on thermal performance of the cross flow heat exchanger will be represented graphically to see the variation and come out with some results.

III. OBJECTIVE

1) To find enhancement in heat transfer coefficient with hybrid nano fluids compared with water with variation in hybrid nano fluids concentration, hybrid nano fluids inlet temperature, hybrid nano fluids volumetric flow rate.
2) CFD analysis of the cross flow heat exchanger with water and hybrid nano fluids as coolant and its comparison with experimental results.

IV. SCOPE

In Future, the next steps in the nano fluidsresearchare to concentrate on the heat transfer enhancement and its physical mechanisms, taking into consideration such items as the optimum particle size and shape, particle volume concentration, fluid additives, particle coating and base fluid. Better characterization of nano fluids is also important for developing engineering designs based on the work of multiple research groups, and fundamental theory to guide this effort should be improved. Important features for commercialization must be addressed, including particle settling, particle agglomeration, surface erosion, and large scale nano fluids production at acceptable cost. Nano fluids offer challenges related to production, properties, heat transfer, and applications.

There appears to be hardly any research in the use of nano fluids as refrigerants. Nanoparticle refrigerant dispersions in two-phase heat transfer applications can be studied to explore the possibility of improving the heat transfer characteristics of condensers and evaporators used in refrigeration and air conditioning appliances. It is necessary to study the development of correlations of friction factor and heat transfer through tubes with nano fluids. Therefore, further studies are needed to develop a generalised hydrodynamic and heat transfer characteristic correlation for nano fluids in a tube. Additionally, a comparison among tube shapes for use in a car radiator can be performed experimentally and numerically. The more research in nano fluids which will define their future in the field of heat transfer is expected to grow at a faster pace in the coming future.

In this section we highlight some future directions in each of these challenging areas.

1. Development of theoretical equations for thermo physical properties of nano fluids is the grey area to be explored.

2. The effect of nanoparticles size on heat transfer and friction characteristics of nano fluids can be taken up for investigation.

3. Study on heat transfer investigation by changing the relative proportion in the base Mehta et al., International Journal of Advanced Engineering Technology E-ISSN 0976-3945IJAET/Vol.III/ Issue IV/Oct.-Dec., 2012/49-54 fluid constituents can be taken up as future work.

4. LITERATURE REVIEW

The following is a brief description of the work and research completed by some prominent researchers in the field of nanofluids, specifically related to this work. This review illustrates the current schools of thought on the factors involved in influencing the properties of nanofluids.

Author performed research on the thermal conductivity of two-component systems because of develop an understanding of the basis of many current modeling equations for nanofluid thermal conductivity. This research dealparticularly with identifying how the shape of the components of a system affected the thermal properties of that system.This experiment provided data supporting the shape effect of metal particles on conductivity,(Hamilton et al, 1962).Performed research specifically on nanofluids with oxide particles at Argonne National Laboratory. This experiment examined Al2O3 and CuO nanoparticles isolated in both demonized water and ethylene glycol and their related thermal conductivities as calculated by the transient hot-wire method. A strong dependence on particle size and an almost linear augment of conductivity with volume fraction of the particles were found. CuO nanoparticles were found to have a better heat transfer effect than Al2O3 particles, which was suggested to be due to the CuO particles being smaller (Lee et al, 2007). The thermal conductivity of Al2O3 and CuO nanoparticles dispersed in various base fluids, including ethylene glycol,water, engine oil and vacuum pump fluid. Thermal conductivity was measured by the use of the steady-state parallel,one-dimensional plate method. This experiment resulted in data that suggests a feasible relation between thermal conductivity and the size of the Nano particles, as well as the method of dispersion used (Wang et al, 1999).

The effect of nanoparticles on convective heat transfer under a laminar flow regime. This research entailed experiments in a piping system of disc shaped graphite nanoparticles dispersions in two different base fluids. The goal was to test the theory of increased heat transfer capabilities without a significant change in flow characteristics such as viscosity. The experiments resulted in data that supports this idea as well as suggesting a number of factors that play a role in the convective heat transfer capabilities of these fluids. However, the correlations used to predict the results were not accurate. Therefore, it has been suggested that further research is needed (Yang et al,2005).Performed research involving a theoretical explanation of the possible reasons for the departure of experimental results from predicted results of thermal conductivities of nanofluids. The authors explain the macroscopic theory of heat transport in composites which is based on the diffusive nature of heat transport and note the mechanisms of enhanced heat conduction such as Brownian motion. There is also a description of the ballistic nature of heat transport which is suggested will better explain the experimental evidence. Research was supported by atomic-level molecular dynamics simulations (Keblinski et al,2005). Conducted research on the convective heat transfer properties of nanofluids and the factors affecting these properties. The purpose of this research was to test the

theory that the effects on heat transfer that are not explained by the thermal conductivity characteristics are attributed to the turbulence induced by the motion of the nano particles and the dispersion methods. (Buongiorno, 2006)Studied the single phase flow heat transfer performance of nano fluids in turbulent flow regimes. The nano fluid used was Cu particles dispersed in water. Substantial increases in the convective heat transfer rates were noted while also noting that the flow characteristics closely resemble those of the base fluid, which suggests that there will be no adverse pumping power requirements associated with the use of nano fluids (Xuan et al,2007).Conducted experiments to determine the temperature dependence of thermal conductivity of nano fluids. It was found that the thermal conductivity increased with temperature from 21 °C to 51^0C, which suggests a possible use as a cooling mechanism in devices with high energy densities (Das et al, 2003).

V. METHODOLOGY

The focus of this study is investigation of heat dissipation for cross flow heat exchanger with conventional coolant based hybrid nano fluid. For the theoretical methodology to developed a test set up for experiment. For experiment performance test will conducted by usinghybrid nanomaterials material as a coolant on heat Exchanger(Radiator of car) Get the reading of water by providing instruments for monitoring various parameters like thermal conductivity moderately. The overall heat transfer coefficient temperature of the nano fluids. The overall heat transfer coefficient. Volumetric flow rate of the nano fluids significantly, analysis of result using CFD obtain on basis of comparison of different types of nano material.

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