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HEAT EXCHANGER BASED ON NANO FLUID

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Abstract - *Nano fluids have improved thermal properties and possible heat transfer rate. Nano fluids plays major role in various applications which increases heat transfer rate as it contains metallic or non-metallic Nano powders with a size of less than 100mm in base fluids so, it increases the heat transfer potential of the base fluids. Water is the working fluid in the heat exchanger and metal based (Cu or Al) Nano fluid of particular concentration will act as a heat carrier. Experimental set up will be manufactured with minimum possible dimensions to reduce the cost. Thermocouples are used to measure the temperature of water and Nano fluid at the inlet and outlet. The flow control valves are used to control the flow rate. The effect of mass flow rate of fluids on heat exchanger was studied. The CATIA model was drawn. The result & conclusion was drawn after the experimental resting.*

***Key Words*: Nano Fluid, Heat Transfer Rate, Thermocouples, Mass flow rate**

1. INTRODUCTION

The energy conservation is one of the vital issues of the twenty-first century, and it will certainly be one of the most significant challenges in the near future. Therefore, scientists, engineers and researchers are considerably trying to address this important concern. The advances made in heating or cooling in industrial devices cause energy saving and heat transfer improvement, and increase the operational life of the equipment. Energy savings can be performed by the efficient use of energy. Energy conversion, conservation and recovery are some routes for energy saving.

To above mentioned purpose, various types of heat exchangers are utilized in many industrial areas such as power plants, nuclear reactors, petrochemical industry, refrigeration, air-conditioning, process industry, solar water heater, food engineering, and chemical reactors.

Different technologies are employed to improve the efficiency of heat exchangers. For decades, efforts have been made to progress heat transfer in heat exchangers, decrease the heat exchange time and finally improve the system efficiency. Augmenting the heat transfer area by adopting fins is frequently used. This technique, however, increases weight and volume of heat exchangers. Therefore, common approaches such as use of fins have now reached their boundaries.

In addition to geometrical modifications, improving the thermal characteristics of the heat transfer fluids can present greater convective heat transfer in heat exchangers. Application of additives to the working fluids to modify their thermo physical properties is an interesting technique for the heat transfer improvement. Recent development in nanotechnology has presented a way to this. To improve heat transfer characteristics of conventional fluids, the concept of "nano fluid" was proposed by Choi in 1995. Combination of conventional fluids and solid nanoparticles called nano fluid. Nano fluids are advanced heat transfer fluids which can overcome the restrictions of poor thermo physical characteristics related to conventional fluids such as low thermal conductivity. Researchers have proven that nano fluids have advantages such as great thermal conductivity and proper stability. Many surveys have been carried out in the field of nano fluids, and some of investigators have reviewed the studies conducted in this area in different fields such as applying nano fluids in boiling heat transfer, convective heat transfer and friction factor correlations of nano fluids, particle migration in nano fluids, magnetic nano fluids, entropy generation in nano fluids, mass transfer in nano fluids, and so forth. Utilizing nano fluids can be one of the most interesting techniques for heat transfer enhancement in heat exchangers. Several researchers have used nano fluids for this purpose.

A heat exchanger is a device used to transfer heat between two or more fluids. In other words, heat exchangers are used in both cooling and heating processes. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact. They are widely used in space heating, refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air. Another example is the heat sink, which is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant.

2. OBJECTIVES

- To design and manufacture heat exchanger.
- To decide metal based nanofluid based on cost and

availability.

- To monitor temperatures of inlets and outlets using thermocouples.
- To select suitable water pumps for circulation of fluids across setup.
- To prepare suitable CAD model or Block diagram based on experimental setup.
- After making experimental testing suitable results and conclusions was stated

3. PROBLEM STATEMENT

Water based heat exchangers have less efficiency in transferring heat from hot to liquid domains. Hence, Effect of suitable Nano fluid will be compared with water based on heat transfer capabilities.

4. METHODOLOGY

Step 1: - We started the work of this project with literature survey. We gathered many research papers which are relevant to this topic. After going through these papers, we learnt about Heat Exchanger.
Step2: - After that the components which are required for our project are decided.
Step 3: - After deciding the components, the 3 D Model and drafting will be done with the help of CATIA software.
Step 4: - The experimental observations was taken.
Step 5: - Result and conclusion was drawn after making the experimental observations.

5. DESIGN

Computer-aided design (**CAD**) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

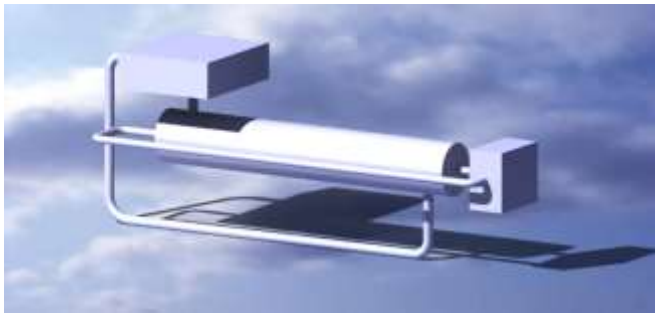

Fig. 1 Heat Exchanger based on Nano fluid

6. WORKING PRINCIPLE:

- The heat exchanger based on the Nano fluid is shown in fig. above. The hot fluid is pumped with the help of pump from the water tank.
- The flow control valve is attached to the pipe after the pump to control the flow rate of water through the pipe.
- The Nano fluid is passed over the pipes from the downward side as shown in fig. above. When hot water passes through the pipe then the heat will be given to the Nano fluid. So, the temperature of water coming out from the pipe is less than that of the inlet temperature of water.
- The Nano fluid is used to increase the efficiency of the heat exchanger. The thermometers are used to measure the inlet and outlet temperature of water and Nano fluid.
- After measuring the temperature and mass flow rate the efficiency of the heat exchanger will be carried out.
- Similarly, this procedure was carried out by using cold water and then after making the comparison the result & conclusion was carried out.

6. FUTURE SCOPE

The heat exchanger is designed and the experimental observations will be carried out with and without Nano fluid and then the results will be obtained.

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