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Cop Enhancement Of Vcr System By Using Nanorefrigerant

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Abstract-

Refrigeration is the process of removal of heat from a space it is where it is unwanted and transferring the same to the surrounding environment. This is produced by evaporation of liquid refrigerant in VCR system.The coefficient of performance (COP) of VCR system is depends on the refrigeration effect and work required the rate of heat transfer or by reducing the compressor work.It has been found that nanorefrigerant have much higher and strongly temperature dependent thermal conductivity than conventional refrigerant and it improve the thermo-physical properties. This can be considered as one of the key parameter of enhanced performance for refrigeration system. For this project we will use R134a as a base refrigerant and the R600a (Nano refrigerant) will be added to study its effect on COP. The R600a will be added at different proportions such as 0.5%, 1.0% and 1.5%. Based on the results most suitable proportion of nano refrigerant will be suggested.

Keywords- *Nanofluids, COP, Power consumption, Thermal conductivity*

INTRODUCTION

It is true that rapid industrialization has led to unprecedented growth, development and technological advancement across the globe. It has also given rise to several new concerns. Today global warming and ozone layer depletion on the one hand and spiraling oil prices on the other hand have become main challenges. Excessive use of fossil fuels is leading to their sharp diminution and nuclear energy is not out of harm's way. In the face of imminent energy resource crunch there is need for developing thermal systems which are energy efficient. Thermal systems like refrigerators and air conditioners consume large amount of electric power. So avenues of developing energy efficient refrigeration and air conditioning systems with nature friendly refrigerants need to be explored.[1] The rapid advances in nanotechnology have lead to emerging of new generation heat transfer fluids called nanofluids. Nanofluids are prepared by suspending nano sized particles (1-100nm) in conventional fluids and have higher thermal conductivity than the base fluids. Nanofluids have the following characteristics compared to the normal solid liquid suspensions. i) higher heat transfer between the particles and fluids due to the high surface area of the particles ii) better dispersion stability with predominant Brownian motion iii)reduces particle clogging iv) reduced pumping power as compared to base fluid to obtain equivalent heat transfer. Based on the applications, nanoparticles are currently made out of a very wide variety of materials, the most common of the new generation of nanoparticles being ceramics, which are best split into metal oxide ceramics, such as titanium, zinc, aluminium and iron oxides, to name a prominent few and silicate nanoparticles, generally in the form of nanoscale flakes of clay.[2]Addition of nanoparticles changes the boiling characteristics of the base fluids. Nanoparticles can be used in refrigeration systems because of its remarkable improvement in thermophysical and heat transfer capabilities to enhance the performance of refrigeration systems. In a vapour compression refrigeration system the nanoparticles can be added to the lubricant (compressoroil).

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PREPARATION OF NANO REFRIGERANT

The Nano refrigerant used in this experiment is R134a-CuO. The preparation of Nano refrigerant is done by the use of magnetic stirrer and ultra Sonicator processor. 2 gm of 50 nm diameter of copper oxide is mixed with 150 ml of lubricating oil and stirred about 2 hrs with the help of magnetic stirrer. Then the Nano refrigerant is placed in ultra sonicator processor to obtain flow properties for the copper nanoparticles. Then the Nano particles are separated from the lubricating oil by filtration process. These Nano particles are injected into the compressor through suction port or charging port along with the base refrigerant R134a. The complex correlation between all these parameter on the performance of nanofluid in shown in Fig. 1.1. Here we can see that all parameter for example when we increase the concentration of nanoparticle in base fluid the all 4 thermo physical of nanofluid will be change.

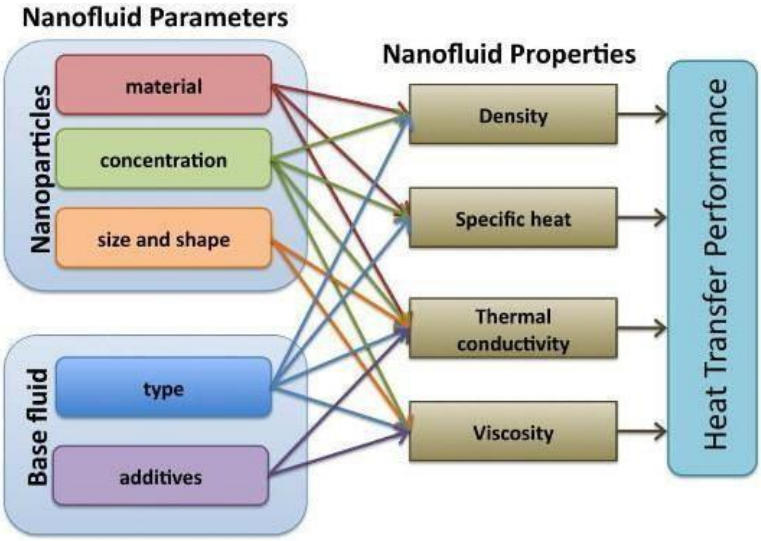

Fig. 1. Complexity and multi-variability of nanoparticle suspensions

LITERATURE REVIEW

1. **R.S. Mishra,DevendraKumar Experimental investigation for enhancing thermal performance of vapour compression refrigeration system using nano fluids:-**For increasing first law efficiency in terms of COP and Second law efficiency (Exergetic Efficiency) of VCR systems.the experiment is performed on VCR system to study the effect of silver oxide Nano particle(50nm) in base fluid of ethyl glycol (50:50 ratio with water) with concentration factor 0.02 to 0.06g by volume % on hot side of system (condenser side). For high efficiency out-put, the plate type heat exchanger has been taken in the VCR system. Test results show that the performance parameters such as exergetic efficiency of the system improved in the range of 1.9- 5.96% and heating capacity was improved by 26-82% respectively by using 0.06 Vol% silver Nano fluid compared to water as cold based fluid for considerable range of cold base fluid flow rate. It was observed that the exergy destruction is decreasing in the range of 29-31.28%, 65.77-70.01%, 14.31-16.03%, 17-23% in compressor, condenser, evaporator and expansion valve respectively. High volume ratio (0.015 Vol%) of silver Nano fluid shows a very less effect on thermal performance parameters of system for different base fluid mass flow rates.

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ENHANCEMENT OF VAPOUR COMPRESSION REFRIGERATION SYSTEM

Now days, refrigeration systems have become one of the most important systems for people's daily lives. So the use of refrigerants is increasing day by day. In past five years, nano-refrigerant has become the input for large number of experimental and vapours compression systems because of shortage of energy and environmental considerations. The conventional

refrigerants have major role in global warming and depletion of the ozone layer By adding nanoparticles with refrigerants the coefficient of performance, heat transfer rate and thermal conductivity will increased. Because of that power consumption rate will be reduced. This paper compares cofficient of performance of refrigeration system with nanorefrigerants and without nanorefrigerants such as R134a, Mo49 and blend of R290 and R600a

3.Jayendra, Sanket, Sagar, Vinesh, Yuken, Kaushal EFFECT OF NANOREFRIGERANT ON PERFORMANCE OF VCR SYSTEM A REVIEW

Refrigeration is the process of removal of heat from a space it is where it is unwanted and transferring the same to the surrounding environment. This is produced by evaporation of liquid refrigerant in VCR system. The coefficient of performance (cop) of VCR system is depends on the refrigeration effect and work required the rate of heat transfer or by reducing the compressor work. Recently it is found that the use of nanotechnology in the refrigeration system can increase the performance of system. In this technique the nanoparticles are added in to the base fluid which is refrigerant or compressor oil (lubricating oil).

SOLUTION METHODOLOGY

In this chapter we discussed about the solution methodology of the various formulation used for design components of the system, we use for solution of formulation of the components by EES (Engineering equation solver) in which we supply the initial conditions of the software before solving, there should be No. of equations is equal to No. of variables.

First all of write all the equation for design of the components of the system. Then we put inputs as per our model and for output we put some guess values in the software then solve the equations one after one components. First we design evaporator then compressor then condenser. For design evaporator we "comment" the other components and check the No. of equations is equal to No. of variables then solve the formulation, if there is some error while solving then we update our guess nearest values of our design.For the design of the components set all the inputs like, size of the evaporator and condenser, mass flow rate of brine and water, compressor speed, Temperature of brine and water. So, as per our objective to constant our inputs data we use various nearest replacement of eco-friendly refrigerants on the same configuration then compare the outputs as per various refrigerants used like, R134a, R404a, R407c, R290. It also has been found that nanorefrigerant have much higher and strongly temperature dependent thermal conductivity than conventional refrigerant and it improve the thermo-physical properties. This can be considered as one of the key parameter of enhanced performance for refrigeration system. For this project will first find all the available nanoparticles and we will also find their all properties and cost. After collecting all these data we will select one of the most suitable nanoparticles and mix them at proper concentration. This project is performed in order to check and clarify the effect of nanorefrigerant properties on heat transfer compared to pure refrigerant in refrigeration system.

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EXPERIMENTAL ANALYSIS.

Fig. 2.Experimental Setup

The experimental test is conducted on a domestic refrigerator with vapour refrigeration cycle working with refrigerant R-134a. Refrigerator test rig was developed in order to investigate the performance of the system. In developing the reliable refrigerator test rig, consideration should be highly taken care especially the development method and measurement locations of pressure and temperature. These are very important to ensure that the test rig can produce reliable data. A test rig was developed as shown in the figure. There are five points of temperature measurement, two points of pressure measurement. The thermocouple wire was used to measure the temperature of refrigerant in the tube. In order to know the performance characteristics of the vapour compression refrigeration system the temperature and pressure gauges are installed at each entry and exit of the component. Experiments are conducted by placing of shell and tube heat exchanger after the condenser. Different types of tools are also used tube cutter to cut the tubes and tube bender to bend the copper tube to the required angle. Finally the domestic refrigerator is fabricated as for the requirement of the project. All the values of pressures and temperatures are tabulated.

CONCLUSIONS

The Purpose of this research was carried out for inspecting thermophysical properties of mixed nanorefrigerants. Three different nanoparticles (Al_2O_3, Cu and SiC) and mixed refrigerant of R290/R600a were synthesized individually to form mixed nanorefrigerant. The operating conditions were 3Mpa Pressure and 300 K Temperature respectively. Results are calculated for density, thermal conductivity, viscosity and specific heat of mixed nanorefrigerant.

From the results, we conclude following points

- Density of mixed nanorefrigerant increases with increase in volume concentration of nanoparticles.
- Thermal conductivity of mixed nanorefrigerant increases with increase in volume concentration of nanoparticles.
- Viscosity of mixed nanorefrigerant increases with increase in volume concentration of nanoparticles.
- Specific heat of mixed nanorefrigerant decreases with increase in volume concentration of nanoparticles.

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