OPTIMIZATION OF PERFORMANCE IN DOMESTIC REFRIGERATOR USING R600a/NANO-CuO AS WORKING FLUID

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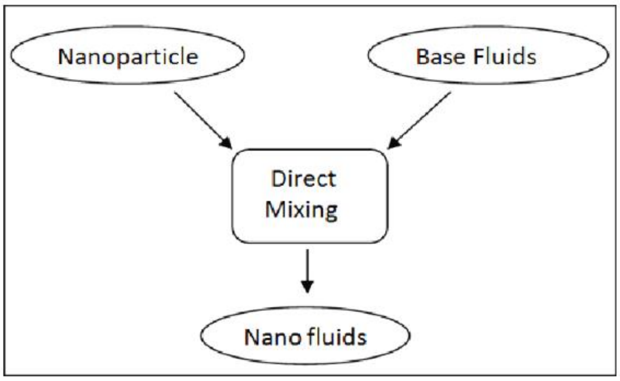
Abstract - *The vapour compression refrigeration system is used in commercial application, industrial application, petrochemical industries, domestic application. Performance of this system is more important for initial cost as well as maintain cost and long-time cost.so performance improvement of refrigeration system is challenge to the organization. The performance of the refrigeration system depends upon the heat transfer capacity of the refrigerant. Normally R12, R22, R600, R600a and 134a are used as a refrigerant. This refrigerant heat transfer capacity is not so good and increase power consumption. Due to these limitations nano fluids are enhanced with the normal lubricant to increase the heat transfer capacity and reduce the power consumption. Copper oxide nano fluid is used for enhancing the heat transfer capacity of the refrigerant in the refrigeration System. In this experiment heat transfer enhancement was investigated numerically on the surface of a refrigerator by using R600a CuOnano-refrigerants, where nano fluids could be a significant factor in maintaining the surface temperature within a required range. The addition of nano particles to the refrigerant results in improvements in the thermo physical properties and heat transfer characteristics of the refrigerant, thereby improving the performance of the refrigeration system. The performance calculation energy consumption COP. This paper work will help to analyze the actual performance of the domestic refrigerator and to suggest the ecofriendly refrigerant for future domestic refrigerators and the power consumption of the refrigerator decreased by the actual cycle*

Key Words: **VCRS, POE Oil, CuO, R600a ,capillary tube, evaporator, COP**

1. INTRODUCTION

What is a NANO Fluid?

A Nano fluid is a fluid containing nanometre-sized particles called nanoparticles. The term Nano comes from a Latin prefix 'Nano'. The prefix is used to denote the 10-9part of a unit. These fluids engineered colloidal suspensions of nanoparticles in a base fluid. Nano fluids are solid-liquid composite materials and can transfer heat across a small temperature difference.



1.2 Why NANO Fluid?

- Low thermal conductivity of process fluid hinders high compactness and effectiveness of heat exchangers, although a variety of techniques is applied to enhance heat transfer. Improvement of the thermal properties of energy transmission fluids may become a trick of augmenting heat transfer. An innovative way of improving the thermal conductivities of fluids is to suspend small solid particles in the fluids.

- The thermal conductivities of fluids with suspended particles are expected to be higher than that of common fluids.

- In conventional cases, the suspended particles are of lm or even mm dimensions. Such large particles may cause some severe problems such as abrasion and clogging. Therefore, fluids with suspended large particles have little practical application in heat transfer enhancement. Nano-refrigerant was proposed on the basis of the concept of the nanofluids, which was prepared by mixing the nanoparticles and traditional refrigerant.
- Firstly, nanoparticles can enhance the solubility between the lubricant and the refrigerant. For example, Wang and Xie found that TiO2 nanoparticles could be used as additives to enhance the solubility between mineral oil and hydro fluorocarbon (HFC) refrigerant. The refrigeration systems using the mixture of R134a and mineral oil appended with nanoparticles TiO2, appeared to give better performance by returning more lubricant oil back to the compressor, and had the similar

performance compared to the systems using polyester (POE) and R134a

2.1 EXPERIMENTAL SET UP

The experimental set up of vapour compression refrigeration system to preparations of the nano fluids by flowing method

2.1 Two-Step Method

This method is the most widely used for preparing nanofluids. Nanoparticles, nanofibers, nanotubes, or other nanomaterials used in this method are first produced as dry powders by chemical or physical methods. Then, the nano-sized powder will be dispersed into a fluid in the second processing step with the help of intensive magnetic force agitation, ultrasonic agitation, high-shear mixing, homogenizing, and ball milling. Two-step method is the most economic method to produce nanofluids in large scale, because nanopowder synthesis techniques have already been scaled up to industrial production levels. Due to the high surface area and surface activity, nanoparticles have the tendency to aggregate. The important technique to enhance the stability of nanoparticles in fluids is the use of surfactants. However, the functionality of the surfactants under high temperature is also a big concern, especially for high-temperature applications. Due to the difficulty in preparing stable nanofluids by two-step method, several advanced techniques are developed to produce nanofluids

Steps involved in the present experimental work

1. Preparations of nano particles and nano fluid (CuO + POE oil) with mangantic sterilization.

Figure 2: Cuo Nano Powder

2. Charging of nanofluid (CuO + POE oil) into the compressor

Figure 2: POE oil

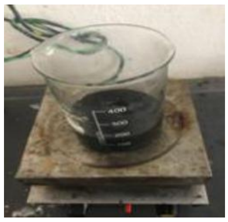


Figure 3: CuO nanofluid

2. Analysis of the system performance and calculations.

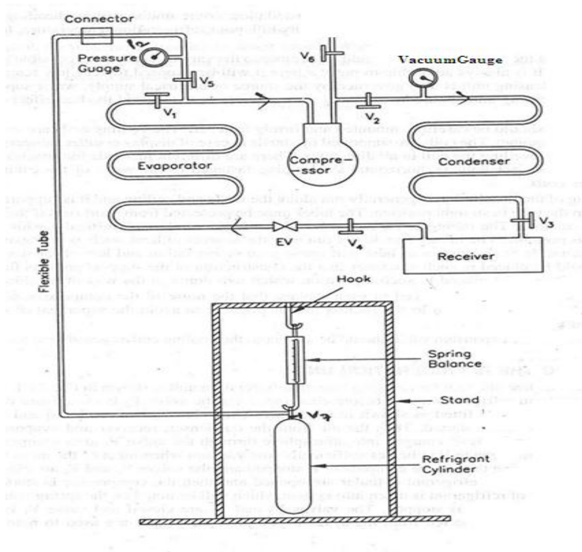


Fig. Charging of Refrigeration System.

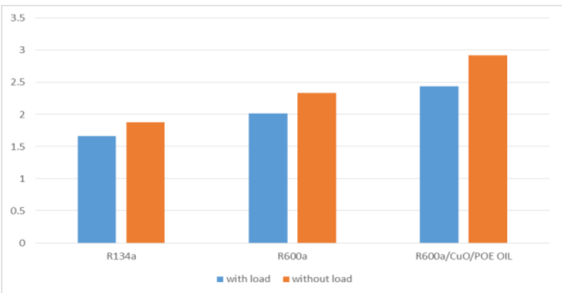
3. PROCEDURE

1. In the present work experimental analysis, The domestic refrigerator is selected, working on vapour compression refrigeration system.
2. Pressure and temperature gauges are installed at each entry and exit of the components.
3. R134a, R600a, R600a/CuO/POE Oil refrigerant is charged in to the vapour compression refrigeration system.

4. Experiment is conducted in three phases. In phase I VCR system with R134a, in phase II VCR system with R600a and in phase III VCR system with R600a-CuO-POE Oil as refrigerant.
5. The experiment is conducted by the no load and with load conditions by decreasing the evaporator temperature for every 50 c till the temperature -50 c.
6. Switch on the refrigerator and observation is required for some time and take the pressure and temperature readings at each section in both phases separately.
7. The performance of the existing system is investigated, with the help of temperature and pressure gauge readings.
8. I concluded that the total values for calculating COP, Energy Consumption at 50c

4. Results & Discussion

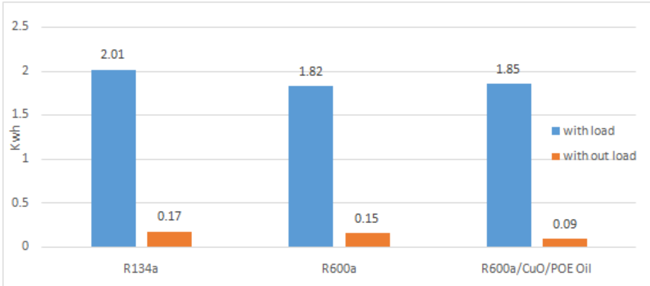
Comparison of COP of R134a, R600a and R600a/CuO/POE Oil as refrigerant



Graph 1 Comparison of COP of R134a, R600a and R600a/CuO/POE Oil

The above graph show that COP of the different refrigerant using the R134a, R600a and R600a/CuO/POE Oil and also for different refrigerants comparing with load and without load. For the all refrigerants COP of without load is higher than the with load R600a /CuO/POE Oil and R600a has higher than R134a because of CuO has the higher heat transfer rate than the normal R600a.due to the some rich properties of R600a has COP increased than the R134a.

Comparison of Energy consumption R134a, R600a and R600a/CuO/POE Oil as refrigerant



Graph 2Comparison of Energy consumption R134a, R600a and R600a/CuO/POE Oil

The above graph show that Energy consumption of the different refrigerant using the R134a, R600a and R600a/CuO/POE Oil and also for different refrigerants comparing with load and without load. For the all refrigerants Energy consumption of without load is higher than the with load R600a /CuO/POE Oil and R600a has higher than R134a because of CuO has the higher heat transfer rate than the normal R600a, due to the some rich properties of R600a has Energy consumption decreased than the R134a.

4. CONCLUSION

The experimental work is carried out and performance of domestic refrigerator is evaluated with R-134a, R600a and R600a/CuO/POE Oil as refrigerants. The present experimental work has been taken up to study compare the Coefficient of performance, energy consumption, The COP of the domestic refrigerator R600a/CuO/POE Oil as refrigerant has 55.31% higher than the R134a refrigerant. Energy consumption of the domestic refrigerator R600A/CuO/POE Oil as refrigerant has 47.05% lower than the R134a refrigerant

ACKNOWLEDGEMENT

I would like to thank all the persons who helped in the completion of his experimental work. Also, thanks are extending my thanks to ASR College of Engineering, Tanuku, INDIA for support throughout the execution of the experimental work

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BIOGRAPHIES

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