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Effect of Titanium Oxide Nano Lubricants Applied to R134a Refrigeration System

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Abstract: ***In this work experiment is performed by using titanium oxide (Tio2) nanoparticles at three different nanoaparticles containing lubricants 0.2g/l,0.4g/l as well as 0.6g/l . An experiment was performed by dispersing titanium oxide (Tio2) nanoparticles and the variables such as compressor work, Coefficient of performance (C.O.P) and refrigeration has been analysed.The experiment was conducted with R134a refrigerant under steady state conditions.Inclusion of Tio2 nanoparticles improved the coefficient as well as cooling capacity of presentation and the compressor work is get reduced.***

Keywords: Coefficient of performance, Nanolubricants, R134a, Tio2 nanoparticles.

I. INTRODUCTION

The steam compression refrigeration cycles are old in, commercial, industrial application as well as domestic,. Because of the general use of these systems in particular cooling systems and heat pumps they represent a high order for energy approximately the world. Therefore constant research and development activities are important in order to maximize their impact. By dispersing nanoparticles in traditional lubricant oil which is known because a nanolubricant, is a new approach to humanizing oil organization performance.

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II. LITERATURE REVIEW ON NANOLUBRICANTS

There has been a research attempt and the explanation of the effects of diamond nanoparticles preservative toward stone oil lubrication as well as be noticed that equally.

The average coefficient of resistance and wear was decreased by the introduction of diamond nano particles. 0.01 percent of weight increased wear and lubricating performance [1]. Diamond nanoparticles used for testing are put together in various concentrations which ranges from 0 to 0.8 wt per cent. [2]. A nanolubricant which has diamond nanoparticles live varied by R134a on three dissimilar accumulation Concentrations of polyolester oil at a volume constituent of 2.6 percent. Diamond nanoparticles raise at one time the high temperature move compared to high temperature Movement of pure R134a by 98 per cent on average [3]. By the experiment results it can be suggested that R113/oil combination containing shape nanoparticles move nucleate lake boiling high temperature is of higher quality .The result of the shape of nanoparticles put up with oil is higher than that of CuO nanoparticles put up with oil in the nucleate lake heat movement. [4]. By employing 0.1 % of Tio2 nanoparticle in refrigeration system using 134a refrigerant ,compressor which contains mineral oil takes up 26.1 per cent of energy compared to refrigeration system having HFC134a with compressor containing polyolester oil [5]. The experiment concludes that freezing potential is higher when POE oil is used instead of using a mixture with aluminum nanoparticles, mineral oil and a reduction in power consumption by 25% [6].

By calculating 0.2% volume portion of Al2O3 nanoparticles, system performance has been enhanced and 10.32% energy consumption is less when compared with R134a working fluid [7].

III. PROPOSED SYSTEM

A. Experimental system

Experiment is carried out in refrigerator originally charged with R134a .The research be conducted in a trained laboratory room and the temperatures maintained at the range of 29–32°C.The digital thermocouple K used to calculate sucti on temperature (T1), discharge temperature (T2), condensin g temperature (T3) as well as evaporator air temperatures (T AIR) as well as digital pressure gages used to assess suction and discharge pressure (P1) and (P2) and the refrigerator's p ower consumption was experimental with a digital wattmeter . The experimental test rig is shown in fig. 1.

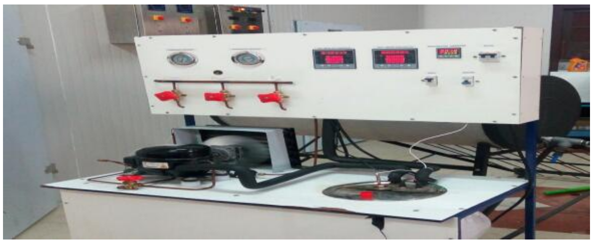

Fig. 1. Experimetal Test Rig

Nanolubricant and refrigerant R134a loaded up the compress or. Every time it was permitted to level out the system for 20 minutes

B. Preperation of Nanolubricant

The Tio_2 nanoparticles dispered in proper quantity for the preparation of nanolubricant and the stability of the particles also preserved. The nanolubricants were prepared in this experiment using two-step procedure. For the 1 hr time span, a Tio_2 are combined with mineral oil using a magnetic stirrer. Nanoparticles then continuously distributed in ultrasonic bath. After that nanoparticles frequently dispersed in ultrasonic bath vibrator .The spectrophotometer of type UV-V is employed for sonification and it ensures that nanoparticles are properly mixed with smaller amount of sediments and enhanced volume of the specified product. The sonicators break down the agglomeration and secure the fine discrete nanoparticle addicted to the bottom response. Within this study, the three dissimilar concentrations of 0.2 percent, 0.4 percent and 0.6 percent of nanolubricant were ready and used.

C. Stability of Nanolubricant

The stabilization of nanolubricants and the ultrasonic bath was used for reducing agglomerate size.

The above mentioned spectrophotometer is used to identify the nanolubricant specimens stability.

IV. RESULTS AND DISCUSSION

The experiment is conduced in four different methods. The compressor contains nano lubricants with Tio2 nanoparticles.

i) with pure lubricating oil

ii) Tio2 containing 0.2g / L nano lubricants

iii) Tio2 containing 0.4g / L nanolubricants

iv) 0.6g / L Tio2 nanolubricants for graphical representation

A. Influence of nanoparticles concentration on refrigeration effect

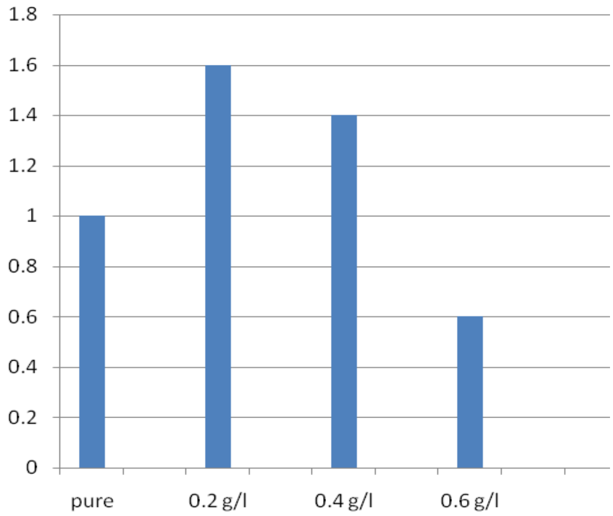

Fig. 2. Nanoparticles concentration vs refrigeration effect

From the Fig. 2 it can be inferred that refrigeration effect of VCR system containing 0.2 g / l Tio_2 nanolubricants is higher than the experiment conducted using pure, Tio_2 containing 0.2 g / l and Tio_2 containing 0.6 g / l.

B. Effect of nanoparticle concentration on Compressor work

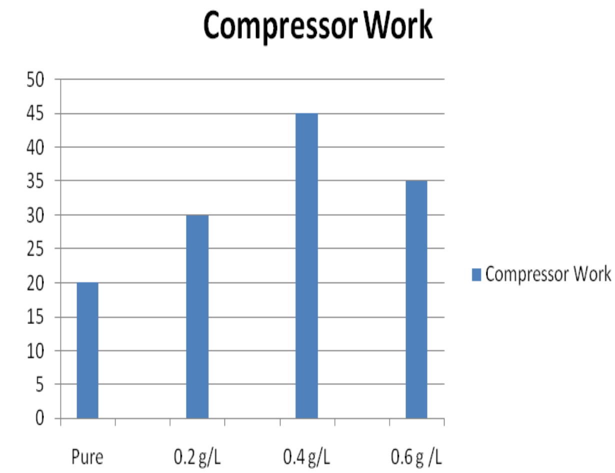

Fig. 3. Nanoparticles concentration vs work ofcompressor

From the above Fig. 3 it can be inferred that work of compression is very low by using lubricating oil without nanopartcles. The compressor work is higher nanolubricant containing 0.4 g / l Tio2.

C. Effect of nanoparticles concentration on Coefficient of Performance (COP)

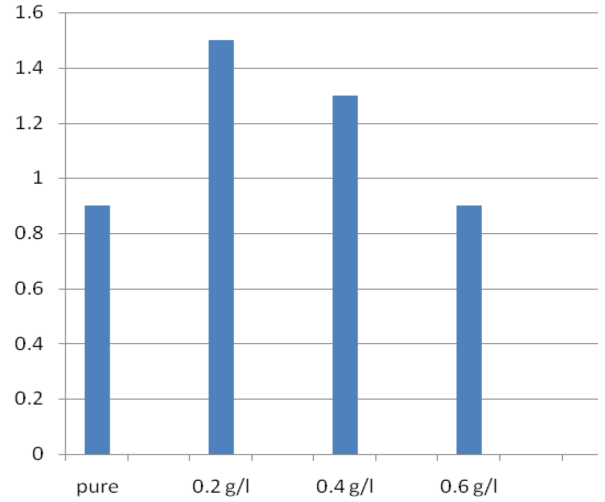

Fig. 4.Effect of nanoparticles on COP

Fig.4. shows the experimental data is calculated by using COP. The COP is designed by the cooling power input as well as cooling load. Tio2, nanoparticles mixture have the maximum COP when compared by the additional cases and it is very much high from the figure that mineral oil +0.2g/l nanoparticle concentration. the advantages of manimold to adding the nanoparticles of lubricant. It is increases the COP and reduces the subcooling of the nano refrigerant as well as power consumptions.

V. CONCLUSION

The presentation of a R134a refrigeration organization was estimated by Tio2 nanolubricants on three dissimilar nanolubricants concentration of 0.2g/l,0.4g/l and 0.6g/l. The refrigeration effect was enhanced by using 0.2g/l Tio2 nanoparticle concentrations with lubricants .

The work of compression is high by adding Tio2 with 0.2 g/l nanoparticle concentration. By using 0.2 g / l Tio2 nanolubricants gives more C.O.P.

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