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DEVELOPING THE AIR CONDENSER PERFORMANCE WITH THE HELP OF NANO FLUID PARTICLES BY UTILIZING OF CAD/CAE TOOLS

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ABSTRACT

Air conditioning systems have condenser that removes unwanted heat from the refrigerant and transfers that heat outdoors. The primary component of a condenser is typically the condenser coil, through which the refrigerant flows. Since, the AC condenser coil contains refrigerant that absorbs heat from the surrounding air, the refrigerant temperature must be higher than the air.

In this thesis heat transfer by convection in AC by varying the refrigerants are determined by CFD and thermal analysis. The assessment is out on an air-cooled tube condenser of a vapor compression cycle for air conditioning system.

In this thesis air condenser were designed by using sold works tool here R143a refrigerant were used to calculate the heat transfer rate and outlet temperature and pressure and velocity distribution values, to increase the heat transfer rate here Nano particles (Zno & Cuo) mixture were added to R143a refrigerant with different amount of percentage, With the help of Ansys fluent tool here values were obtained and compared to R143a refrigerant, by knowing static analysis results it is easy know maximum bearing capacity of the object, while inserting Nano particles it is possible to increase the static pressure on walls, by knowing static analysis results safety factor value at what pressure object can perform without damage, and by knowing Ansys fluent results it is possible to know performance of the object in terms of temperature and velocity and pressure values, finally thesis can conclude with optimum Nano particles with optimum material, and here 2 materials (copper, al-5054) were chosen to analyses the object

INTRODUCTION

In systems involving heat transfer, a condenser is a device or unit used to condense a substance from its gaseous to its liquid state, by cooling it. In so doing, the latent heat is given up by the substance, and will transfer to the condenser coolant. Condensers can be made according to numerous designs, and come in many sizes ranging from rather small (hand-held) to very large (industrial-scale units used in plant processes). For example, a refrigerator uses a condenser to get rid of heat extracted from the interior of the unit to the outside air. Condensers are used in air conditioning, industrial chemical processes such as distillation, steam power plants and other heat-exchange systems. Use of cooling water or surrounding air as the coolant is common in many condensers

Aim of the project

The primary point of the theory is to configuration dissect an air condenser and figuring heat move rate and pressing factor and speed boundaries esteems, here to expand the productivity of the air condenser execution and warmth move rate esteems, Nano particles blends were adding to referents with various measure of rates,

With the help of Ansys fluent tool here values were obtained and compared to R143a refrigerant, by knowing static analysis results it is easy know maximum bearing capacity of the object, while inserting Nano particles it is possible to increase the static pressure on walls, by knowing static analysis results safety factor value at what pressure object can perform without damage, and by knowing Ansys fluent results it is possible to know performance of the object in terms of temperature and velocity and pressure values, finally thesis can conclude with optimum Nano particles with optimum material, and here 2 materials (copper, al-5054) were chosen to analyses the object

Results to be calculated:

- Velocity
- Temperature
- Pressure
- Heat transfer coefficient
- Outlet temperature values

LITERATURE REVIEW

A comprehensive review of the literature on Vapor Absorption Systems, Compression-Absorption System and Vapor Compression System has been carried out on various aspects of energy analysis, the type of cycles analyzed, working pairs used and energy analysis. With regards to vapor absorption cycles, it is found that mostly the studies are carried out on large capacity systems and the investigation had been carried out with in a limited range of system design parameters. The literature on small vapor absorption systems is scant and very few studies have been done on smaller systems. The above studies are simulation studies. Regarding compression-absorption systems studies have been carried out by many researchers mostly analytically and experimentally. The investigations have been done on wet compression cycles which eliminated the need of solution pump. The literature provides details with regard to the applications

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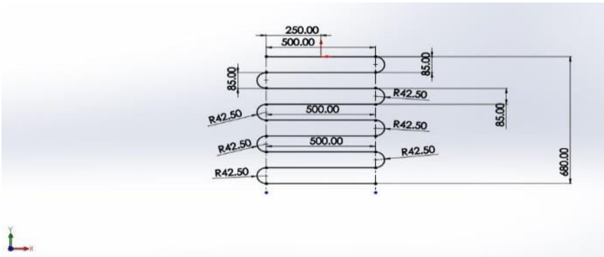
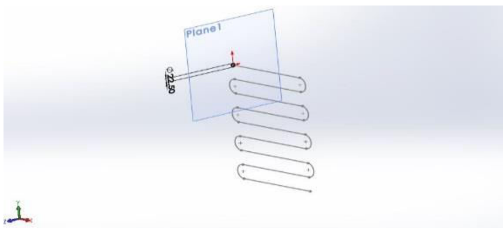
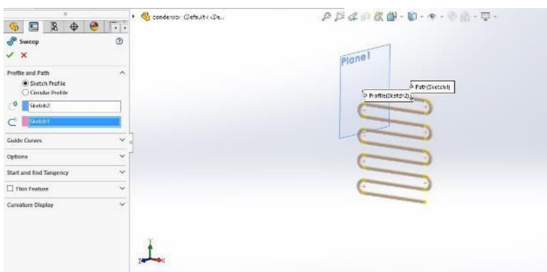
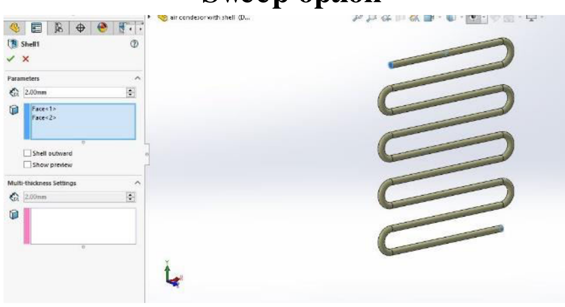
Air condenser designing process step by step

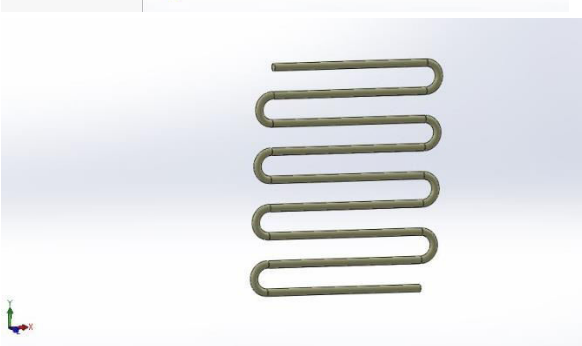






Sweep option





Air condenser final model

Ansys process

Copper alloy

Young's modulus:- *10^11 Pa

Poison ratio:

Density: Kg/m^3

Yield strength: Mpa

Thermal conductivity w/m-k

Al-5054

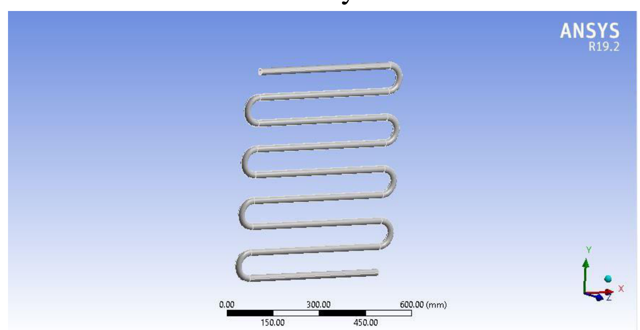
Young's modulus:- *10^11 Pa

Poison ratio:

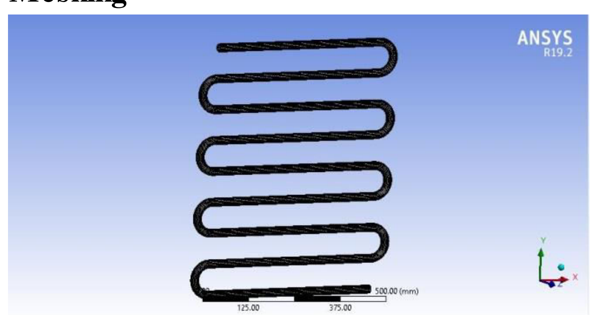
Density: Kg/m^3

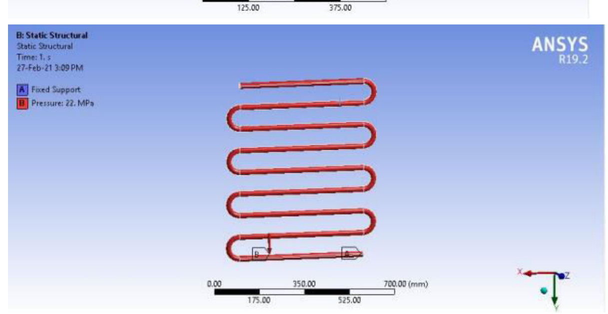
Yield strength: Mpa

Thermal conductivity115 w/m-k



Meshing





Copper alloy

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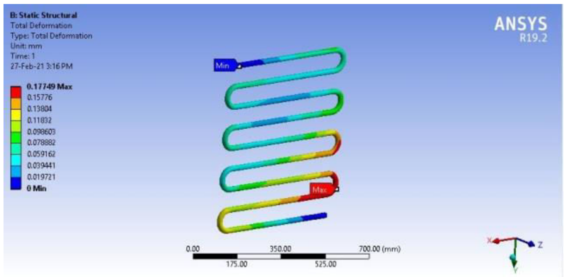
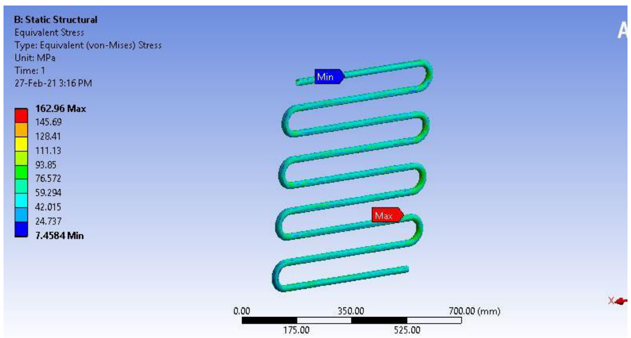
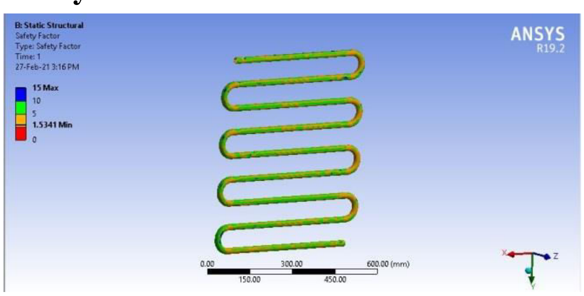
Deformation



Stress



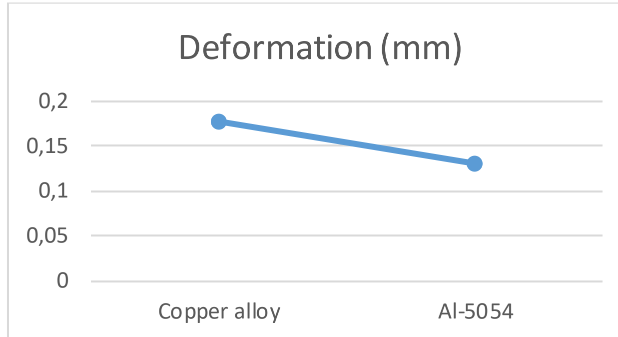
Safety factor

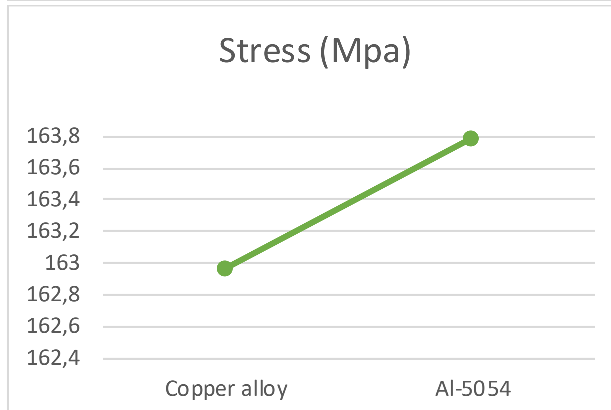


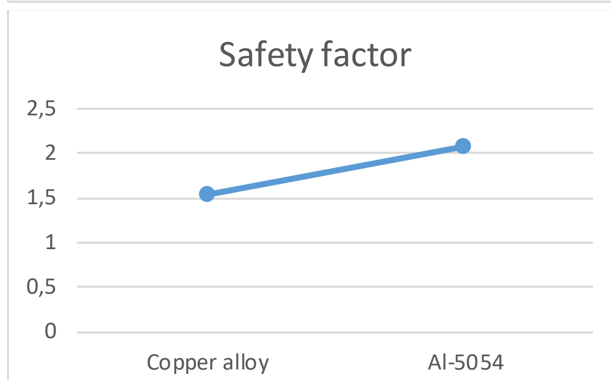
Tables

	Copper alloy	Al-5054
Deformation (mm)	0.17749	0.13167
Stress (Mpa)	162.96	163.79
Strain	0.00085781	0.00063638
Safety factor	1.5341	2.0679

Graphs







Ansys fluent

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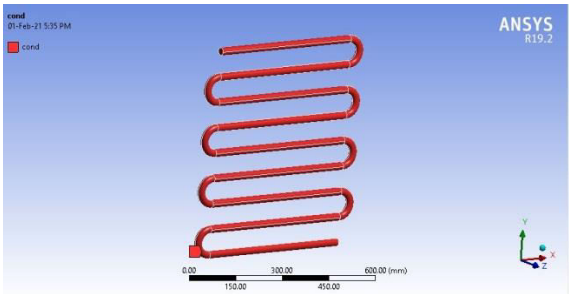
Air condenser boundary conditions



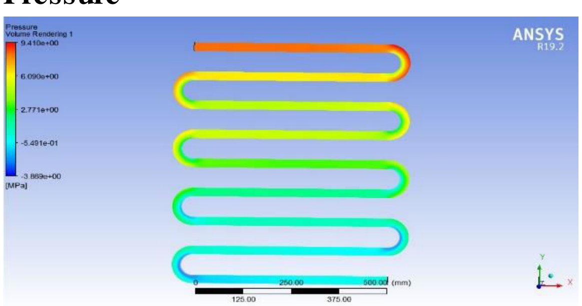
After finishing boundary conditions, now close the window, here inlet velocity as chosen 2m/s and inlet temperature value as 345K and then solve this solution and then click ok, after completing boundary conditions now assign material as al-5054, and refrigerant as r143a/ R143a + 0.5% of zno/cuo- R143 + 1.5% of zno/cuo one after one.

After completing this now initialize the solution, and then enter number iteration values as 2000 and then solve it and then take results, and the final results were shown in below.

Results

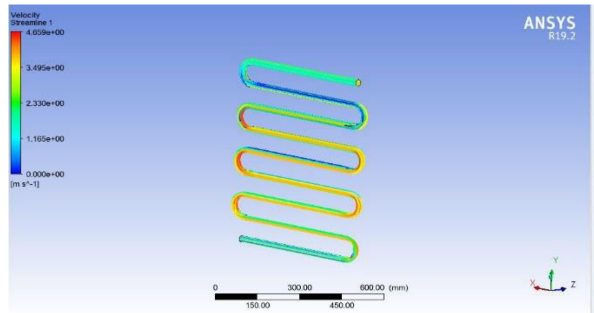
R143a as refrigerant

Pressure



Above image showing pressure values of air condenser for R143a refrigerant, and it has maximum pressure value generated on walls is 9.41Mpa and minimum pressure value is -3.869Mpa values, and these pressure values are under static analysis boundary conditions values,

Velocity

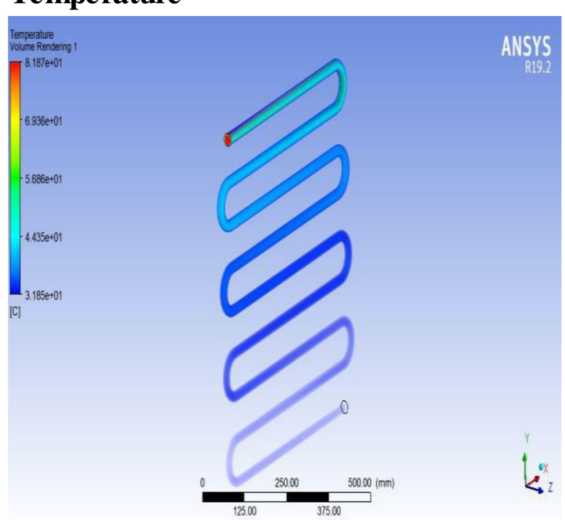


Above image showing velocity values applied on of air condenser walls for R143a refrigerant, and it has maximum velocity value generated on walls is 4.659m/s

Heat transfer coefficient

Mass-Weighted Average Wall Adjacent Heat Transfer Coef.	(w/m2-k)
condensor2	5.8931319
Net	5.8931319

Temperature



Above image showing temperature values of air condenser for R143a

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refrigerant, and it has maximum temperature value generated on walls is 81.87*C and minimum temperature is 31.85*C values,

Inlet out temperature values

```
   Area-Weighted Average
      Static Temperature                (k)
-------------------------------- --------------------
                  inlet               354.99999
                 outlet               302.93673
           ---------------- --------------------
                    Net               328.96828
```

Fluent analysis tables results

	Pressure (Mpa)	Velocity (m/s)	Temperature (*C)	Outlet temperature (*C)	Heat transfer coefficient (w/m^2-K)
R143a refrigerant	9.410	4.659	81.87	29.936	5.893
R22+0.5% zno	8.919	5.062	79.45	23.8	11.403
R22+1.5% zno	7.605	3.674	78.99	37.85	7.40
R22+0.5% cuo	11.63	6.79	81.02	38.85	7.13
R22+1.5% cuo	6.983	4.885	76.65	44.286	7.239

CONCLUSION

In this thesis air condenser were designed by using sold works tool here R143a refrigerant were used to calculate the heat transfer rate and outlet temperature and pressure and velocity distribution values, to increase the heat transfer rate here Nano particles (zno & cuo)mixture were added to R143a refrigerant with different amount of percentage (0.5% &1.5 %). With the help of Ansys fluent tool here values were obtained and compared to R143a refrigerant,

From results it is observe that by adding zno Nano particles the heat transfer coefficient values were increasing compare to R143a refrigerant, and the outlet temperature is also reduced for zno 0.5% mixture, and from static analysis results al-5054 material is having safety factor value near to 2 , when boundary condition applied as 22Mpa , so that this air condenser can withstand maximum amount of pressure on it is 25Mpa, and from fluent analysis results the maximum generated pressure on walls is less than 12Mpa in any refrigerants combinations, so that design is safe while using Nano particles also, and the pressure will not affect the design. Finally thesis concluded with R143a refrigerant with 0.5% zno mixture can increase the overall performance of the air condenser,

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