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"ANALYSIS OF TEMPERATURE DISTRIBUTION OVER THE TUBES OF HEAT EXCHANGER WITHDIFFERENT MATERIAL".

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ABSTRACT

Heat exchanger is one type of device that passing the fluid medium from one place toanother place which were used in different industrial application like power production plant,shippingaswellasbiochemicalenterprises.Theaimofpaperrevealedmakingtubein heatexchanger by modeling ANSYS 17.5 version software. Testing of these model objects will be analyzedbysoftwareofANSYS17.5.Scopeofstudyistoanalyzethetemperaturedistribution & heat flux over the tubes of heat exchanger. The Four important materials (Copper, Silver,aluminum & steel 1010) are changed while doing the above tastings. Lastly, Silver givesbest heat transfer rate comparing with other three materials but while comparing economicalwiseCopperwasdesired. material of shell and tube giving best transfer rate and good thermal efficiency. Even though material properties develop essential once

INTRODUCTION

Heat exchanger is unit of moving source of fluid heat between the regions. A shell tube exchanger is one in which the heat transfer duty has been maximized within the unit's envelope. Greater exhaustion amount & fossil fuel price increment that driven many research people to harness dynamism heat waste from combustion engines that leads to improve the overall performance. With the modern Genetic Algorithm application, design of HTwas optimized. This technique mainly focusing toforecasting heat transients of exchangers because of inlet stream temperaturevariations.The most important part of HE is Condenser Evaporator so changing the conversation a huge quantity of hotness within minimum specified timing in order to give manufacture standards and secure period budget.

The objective of this paper is to optimized tube heat exchangers and comparison of the thermal and heat flow analysis with different materials of heat exchangers for optimum solution usingANSYS mechanical (Steady state thermal).

Heat exchangers may be classified according to their flow arrangement. Counter

current heat exchangers are most efficient because they allow the highest log mean temperature difference between the hot and cold streams. In a cross-flow heat exchanger, the fluids travel roughly perpendicular to one another through the exchanger. For efficiency, heat exchangers are designed to maximize the surface area of the wall between the two fluids, while minimizing resistance to fluid.

OBJECTIVES

1. To Study Temperature distribution over the tubes of heat Exchanger with Different material (Al, Ag, Cu, Steel 1010)

STEADY STATE THERMAL ANALYSIS OF MATERIAL SELECTION

MODELING OF TUBES

Table1GeometricDimensionsofTubes

Parameters	Dimensions
Numberoftubes	7
Length of tubes	2000 mm
Tube inner diameter	20 mm
Tubeouterdiameter	24 mm

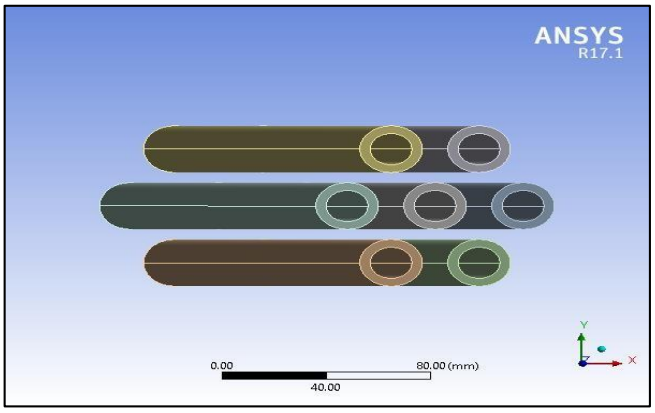


Fig 1 ModelingofTubes

1. Copper

Copper has many desirable properties for thermally efficient and durable heat exchangers. First and foremost, copper is an excellent conductor of heat. This means that copper's high thermal conductivity allows heat to pass through it quickly. Other desirable properties of copper in heat exchangers include its corrosion resistance, biofouling resistance, maximum allowable stress and internal pressure, creep rupture strength, fatigue strength, hardness, thermal expansion, specific heat, antimicrobial properties, tensile strength, yield strength, high melting point, alloy, ease of fabrication, and ease of joining.

In Fig 1 shows the tube of heat exchanger. Copper material used for tubes. Inner Temperature of tube Is 120°C and surrounding water Temperature is 22°C. As The Temperature insidethe Tube Increases after some time outer Surface temperature is increases. Temperature at outer surface is 118.57°C.

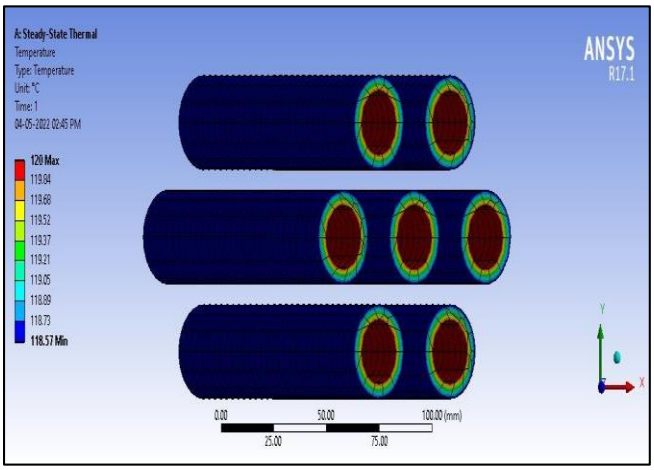


Fig. 2Copper Tube Analysis in Steady State Thermal Analysis

Table 2Result of Copper Tube Steady State Thermal

Thermal Conductivity	Density	Specific Heat	Total Heat Flux	
			Minimum [W/mm²]	Maximum [W/mm²]
0.4W /mm°C	8.933e-006 kg /mm³	9.513.85e+005 mJ/kg°C	0.10474	0.18857

Analysis

2. Aluminum

Aluminum alloys are increasingly used in the manufacture of automotive heat exchangers. The reason is simple: rolled aluminum products have many properties that make them ideal for thermal transfer applications, while being economic and efficient to produce. Attentive to customer needs, we ensure our heat exchanger products and solutions are designed for optimal bribability.

In Fig 2 shows the tube of heat exchanger.Aluminum material used for tubes. Inner Temperature of Tube Is 120°C and surrounding water Temperature is 22°C. As The Temperature inside the Tube Increases after some time outer Surface temperature is increases. Temperature at outer surface is 117.62°C.

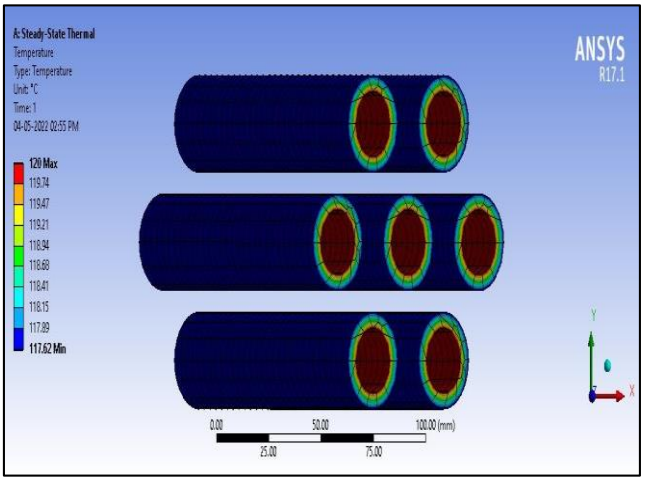


Fig 3 Aluminum Tube Analysis in Steady State Thermal Analysis

Table 3 Result of Aluminum Tube Steady State Thermal Analysis

Thermal Conductivity	Density	Specific Heat	Total Heat Flux	
			Minimum [W/mm²]	Maximum [W/mm²
0.429W /mm°C	1.05e-005kg /mm3	2.35e+005 mJ /kg°C	0.10484	0.18875

3. Silver

Silver metal in its pure state has a brilliant white metallic luster. It is a little harder and is very ductile and malleable. Silver is stable in pure air and water. It has the highest electrical and heat conductivity of all metals and the lowest contact resistance.

In Fig 3 shows the tube of heat exchanger. Silver material used for tubes. Inner Temperature of Tube Is 120°C and surrounding water Temperature is 22°C. As The Temperature inside the Tube Increases after some time outer Surface temperature is increases. Temperature at outer surface is 118.67°C.

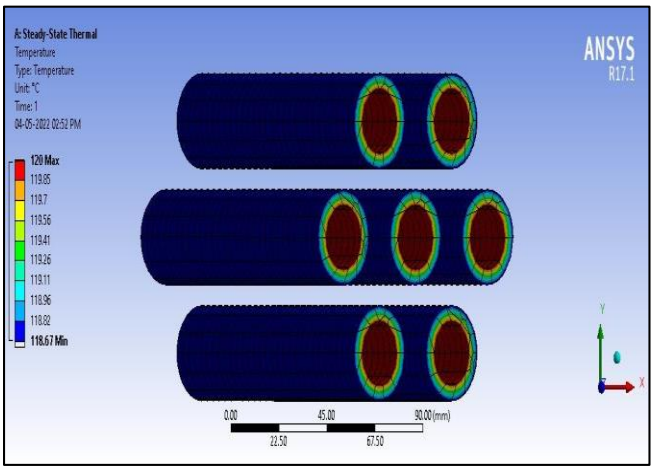


Fig 4 Silver Tube Analysis in Steady State Thermal Analysis

Table 4Result of Silver Tube Steady State Thermal Analysis

Thermal Conductivity	Density	Specific Heat	Total Heat Flux	
			Minimum [W/mm²]	Maximum [W/mm²
0.2375W /mm°C	2.689e-006 kg /mm³	9.51e+005 mJ/kg°C	0.10372	0.18674

4. Steel

AISI 1010 carbon steel is a plain carbon steel with 0.10% carbon content. This steel has relatively low strength but it can be quenched and tempered to increase strength. Steel may be made and delivered in a cost-effective and timely manner.

In Fig 4 shows the tube of heat exchanger. Steel material used for tubes. Inner Temperature of Tube Is 120°C and Surrounding Water Temperature is 22°C. As The Temperature inside the Tube Increases after some time outer Surface

temperature is increases. Temperature at outer surface is 108.62°C.

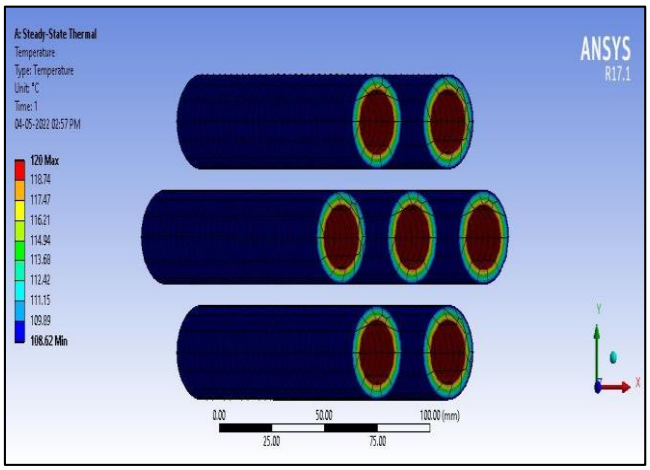


Fig 5 Steel Tube Analysisin Steady State Thermal Analysis

Table 5Result of Steel Tube Steady State Thermal Analysis

Thermal Conductivity	Density	Specific Heat	Total Heat Flux	
			Minimum [W/mm²]	Maximum [W/mm²]
4.5e-002W/mm°C	7.872e-006kg/mm3	4.48e+005mJ/kg°C	9.4074e-002	0.16939

RESULT AND DISCUSSION

Table 6Temperature at outer surface

Sr. No	Material Name	Temperature at Outer Surface
1	Silver (Ag)	118.67°C
2	Copper (Cu)	118.57°C
3	Aluminium (Al)	117.62°C
4	Steel 1010	108.62°C

As the result of steady state thermal analysis in ANSYS 17.5 software we found out that silver (Ag) High rate of heat convection and comparatively copper (Cu) also has high rate of heat convection.

CONCLUSION

Silver has high rate of heat convection but cost of silver is 66,000 Rs per Kg as per (Approximately) Indian market. It is very expensive as compare to other metals that we are analyzing. It becomes major disadvantage of silver. There is no major difference occur in simulation of copper and silver. The cost of copper is 680 Rs per kg as per (Approximately) Indian market. so, we are using copper as our material.

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