Thermal Analysis of Shell and Tube Heat Exchanger with Different Materials

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***Abstract*- Heat transfer is phenomena that rate of heat exchange between the two different body's for this heat transformation in industries are large number of body's we will use. A device which will used to transform heat form one fluid to and another fluid that the device called heat exchanger .we have various industries which are using the heat exchanger like engineering process, refrigeration, air-conditions systems power system, food processing units and chemical reactors.**
In this project we did design of shell and heat exchanger by using the catia v5 r20 after the design we did analysis of heat exchanger by using the ansys14.5 with different materials we calculate the heat flow over the shell and tube heat exchanger

Index terms- heat exchanger, heat transfer, nano fluids, periodic flow, mass flow rate, nusselt number & reynolds number

I. INTRODUCTION

Heat transfer is phenomena that rate of heat exchange between the two different body's for this heat transformation in industries are large number of body's we will use. A device which will used to transform heat form one fluid to and another fluid that the device called heat exchanger .we have various industries which are using the heat exchanger like engineering process, refrigeration, air-conditions systems power system, food processing units and chemical reactors.

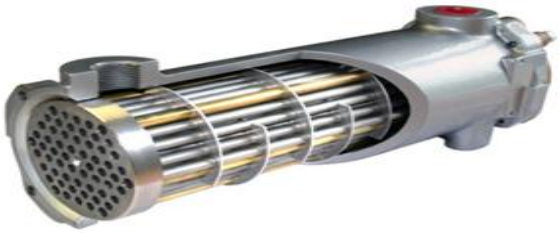

fig 1 shell and tube heat exchanger

Types of heat exchangers
In heat exchangers we have 12 types of those are the 1. Shell and tube 2. Plate heat exchanger 3.plate fin heat exchanger 4.Fluid heat exchanger 5. Plate and shell heat exchanger 6.direct contact heat exchanger 7.pillow plate heat exchanger 8.adiabatic wheel heat exchanger 9.dynamic scraped surface heat exchanger 10 micro channel heat exchanger 11.waste heat exchanger 12.fluid heat exchanger.

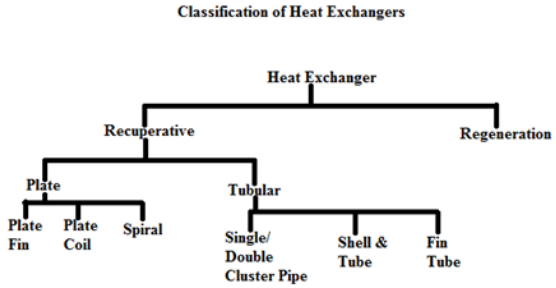

fig 2 classification of heat exchanger

II LITERATURE REVIEW

In the year of 2014 Baydaa rashid ismael, Dr. Aruna kumara from the JNTU-H Hyderabad they worked on the analysis of heat exchanger with different materials they calculated the deformation stress and strain they concluded that brass is better material in their materials.
In the year of 2016 D.AMRUTHA VIJAY, P.SNEHALATHA they did analysis of heat exchanger and they calculated thermal and pressure drop by the empirical formula
In the year of 2017 Basawaraj s. Hasu, Dr.g.v.satynarayana rao from the osmania university Hyderabad they calculate heat flow and mass flowover the heat exchanger

III INTRODUCTION TO CATIA

CATIA is just grasp as computer –aided – style that made-up by the dassult systems within the year of the 1977 as parent company with the participate company as IBM in our technical stream we've got numerous 3d cad modeling package like pro-e, solid works, uni-grphics, solid work etc …but returning catia it's terribly simple ANd clear then all the package's we tend to we tend to mentioned on top of it's a singular feature like all the software's area unit constant quantity based mostly} software's however returning to catia it's an feature based software with victimization one possibility we are able to perform just one perform. catia is came with nearly seventeen totally different modules that utilized in different fields.

in region style they'll use catia tool for the surface style why as a result of this one is versatile tool for the surface style by victimization catia we are able to perform second, 3d modeling, drafting, assembly, wireframe, flat solid style for civil individuals we've got plant style for aerspace we've got generative shaper style currently a days in medical field conjointly they're victimization catia for his or her tool styles.

in recent day the dassult system stared the cam and cae tool in catia therefore currently we tend to doing producing also as analysis conjointly in catia it self.

during this project we tend to style the heat exchanger by victimization the catia v5 r20 with given dimensions we tend to used half style for the look of all the components of the once finishing the half style we tend to we tend tont assembly module for the assembly we tend to did assembly of the components that we styleed partially design module.

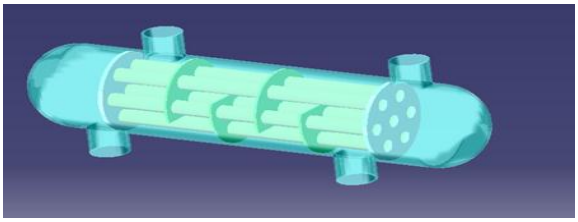

Fig 3 shell and tube heat exchanger in catia

IV INTRODUCTION TO FEM

The Finite-Element –Method is a numerical technique to find approximate solutions with using partial differential equations it was started with need of solving complex problems in aerospace, mechanical and civil engineering in this structural analysis we will calculate the strength, stiffness of the structure and weight of the structure.

latter on it came with the heat equations vibration analysis flow analysis by using this fem analysis we have different types of fem tools which originated in 1970's i.e. Ansys, hyper mesh, ABAQUS, ls-dyna, nastran etc

in this project we used Ansys as a analysis tool. Ansys was invented by the john Swanson in the year of 1970.it made numerous acquisitions for the engineering companies. in this Ansys we have nearly 24 types of analysis. it used for structural, thermal, fluid dynamics electronic design and other analysis.

THERMAL -ANALYSIS

In this paper we design disc brake in catia v5r20 after completion of the design we stared a process in Ansys here we did study state thermal analys in this first step is engineering data in this engineering date we gave the materials that we mentioned in our abstract i.e.Structural and titanium alloy. after the completion of engineering data we went to second step the geometry in this step we imported the design which we did in catia. before import the design we saved that part design in .igs format then we wiil get that model in to the ansys after completion of the importing we did meshing after that we gave the thermal loading and boundary conditions in the last stage we calculate the temperature distributions over the piston head also we calculate the heat flux, directional heat flux for all the three materials.

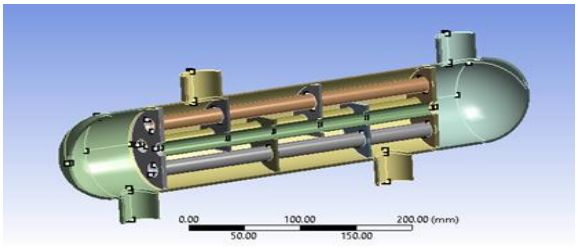

fig 4 heat exchanger

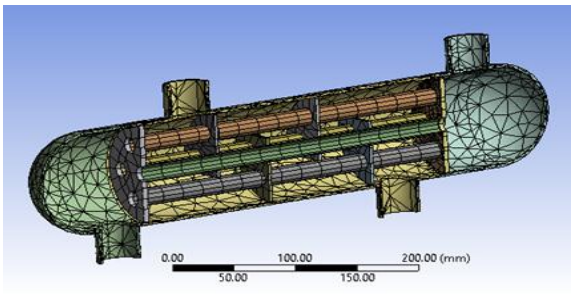

fig 5 mesh model in ansys

RESULT AND DISCUSSION

Structural steel

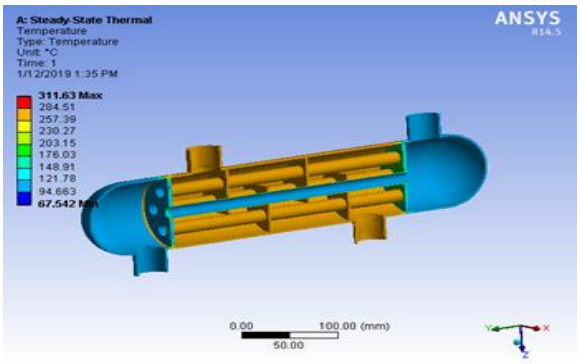

fig 6 Total temperature

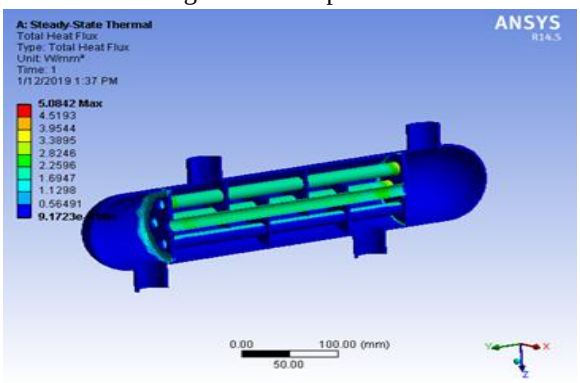

fig 7 total heat flux

titanium alloy

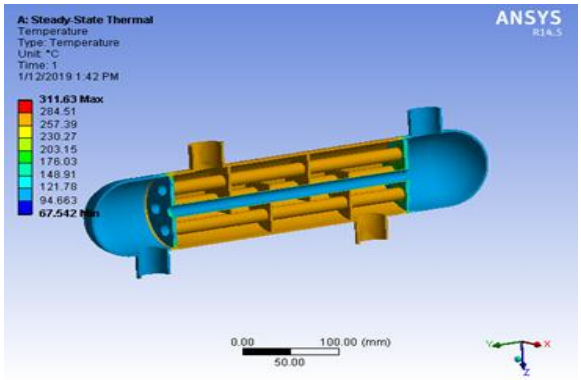

fig 8 total temperature

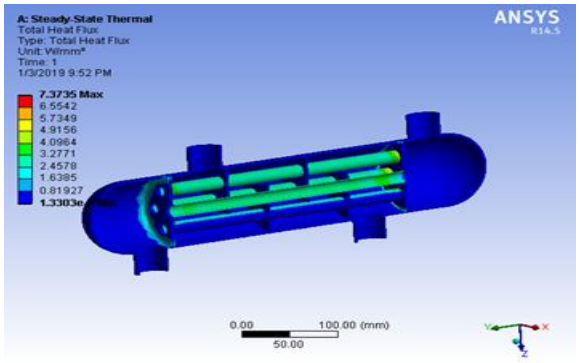

fig 9 total heat flux

From the above analysis of heat exchanger in ANSYS 14.5 the results are collected in tabular form for both materials. We have noticed a change in both temperature basis and static factors

COMPARISON TABLE FOR STEADY STATE THERMAL ANALYSIS

properties	structural stell	titanium alloy
Conduction temperature,(c)	311.63	5.0842
Total heat flux, (w/m^2)	311.63	7.3735

V. CONCLUSION

Our project is to plan and examination of state thermal on shell amd tube exchanger. We have planned piston utilizing cad programming specifically catia v5 and investigation is finished utilizing ansys 14.5 and the thermal and static examination is drawn under required limit conditions. we broke down structural steel and titanium alloy for better thermal conditions and distortion factors.

We have seen that combination material subsequent to including titanium alloy indicates great outcomes when contrasted with standard composite material

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