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Heat Transfer Analysis Of Triplex Tube Heat Exchanger By Ansys

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Abstract

Triplex tube heat exchanger of two models designed for our required dimension was done by the solid works 2010 package then it was converted into Para solid format. The analysis done by the Ansys 12.0 workbench. The model was imported to workbench the meshing process and the named selection also done. The meshed model was opened in the Ansys fluent. The boundary conditions were done finally the how much amount heat transfer was obtained for the given boundary condition in the triplex tube models. The effect of fin length for the heat transfer was calculated.it shows that the increase in length of the fin increase heat transfer. But decrease the time. The optimum length is increase the efficiency of the fin.

Keywords: *triplex tube heat exchanger, internal fins, external fins*

1. Introduction

In the recent year, due to problems of fast depletion of conventional energy sources and ever increasing demand of energy, the implementation of proper thermal energy storage is one of the most important issues in energy conversion systems. Indeed storage is an important element to improve the efficiency of thermal energy utilization in various branches of industries. In general, there are three types for storing the thermal energy: sensible, latent and thermo-chemical heat or cold storage. Among these energy storage types, the most attractive form is latent heat storage in a phase change material (PCM) due to having many useful properties including heat source at constant temperature, heat recovery with small temperature drop. So to avoid the temperature drop and increase the heat transfer rate by changing the dimension of the heat transfer area.

Abduljalil A, et al investigate the set of three concentric tubes with internal and external fin all tubes are made from copper to ensure high thermal conductivity and to high heat transfer between the PCM and the HTF .many numbers of fins were incorporated to the for cases A, B, C, and D. Fin lengths were extended to fill the gap between the inner and the center tubes. The fin was welded to the tubes to create a separate PCM unit geometry to fill with PCM the different number of PCM unit geometries cases E, F, and G . The fin length and fin thickness parameters of case D were investigated in detail. he concluded that the fin dimension increase the heat transfer rate and reduce the melting time.**Yonatan Cadavid** et al proposed a simplified heat transfer model and calculation scheme for energy efficiency, as well as an experimental evaluation of a compact heat recovery unit based on a honey comb structure using an alumina matrix as the heat transfer medium.This model can be used as a tool for sizing or for diagnosis purposes.The model uses a finite volume method for energy equation discretization. The pressure drop is calculated using the Fanningfriction factor for laminar flow in a square section. Additionally, the model takes into account variations in the physical properties of fluid with respect to temperature, and it is assumed that the solid phase and the fluid phase are not in thermal equilibrium with each other. Therefore, the solid matrix and the fluid each have an associated energy equation.(effectiveness) the hydraulic diameter or any characteristic flow length is reduced several scenarios with regard to the following three implications must be assessed: as follows According to the channel size, traditional transport phenomena models may be not accurate due to the effect of rarefaction phenomenon. Increases in the pumping power or pressure drop may be seen across the system. **M.Premkumar** et al concluded that the heat transfer is enhanced in copper spherical encapsulation with fins than that of copper spherical encapsulation without fins. Also we can note that the heat transfer in copper cylindrical encapsulation with fins is slightly better than that copper spherical encapsulation. Finally, the insertion of fin structure enhances the heat transfer rate between the heat transfer fluid and phase change material irrespective of its material and shape. **Thomas perrotin,et al** investigate and a comparison of the usual analytical methods used for fin efficiency calculation in continuous fin-and-tube heat exchangers have been performed. 2-D numerical models of rectangular and hexagonal fins have been performed in order to quantify the 1-D assumption validity used in the sector method and equivalent circular fin method. The sector method is in good agreement with the fin efficiency numerically calculated when the longitudinal tube pitch to transversal tube pitch ratio is near 1. When this ratio is higher, the sector method underestimates the fin efficiency. The same trends are shown for the equivalent circular fin method, but the results are in better agreement and it is preferable to use the equivalent circular fin method in the case of plain fins. **Qusay R. Al-Hagag** investigate Heat exchange with fins was examined and we can find convection term is important factor in calculation of surface temperature. Comparison between solution from ANSYS and direct calculation of ODE indicates that the former might get the more exact estimated value than the latter which needs more assumptions. Even though consideration of radiation is important in the natural convection system, it can be easily ignored when convection becomes significant term. **Pulkit Agarwal, et al** The temperature and heat transfer coefficient values from fin base to tip are not uniform which shows the major advantage of CFD for analysis of heat transfer. The extra heat loss which takes place in the regions of subzero temperature has been found out. Using this data, the amount of fuel conserved can be easily calculated. A method of preventing this excessive heat loss is to use a diffuser in the path of air before it strikes the engine surface. This will help in reducing the air velocity and help in improving the efficiency of the engine. From the literature survey we conclude that dimension of fins and material used and velocity of the fluid is important in heat transfer

2. Methodology

In this study two TTHX model was designed.in those model fin length only changed other dimensions are same. At first the modeling was obtained then it converted into Para solid format or IGES format. The analysis was done on the ansys workbench 12.0. the standard mesh was done on the model, then it was imported to the FLUENT package. The boundary condition are given to the model, also number of iteration was given. The velocity was changed and the heat transfer rate was determined.

2.1 Meshing & Named Selection:

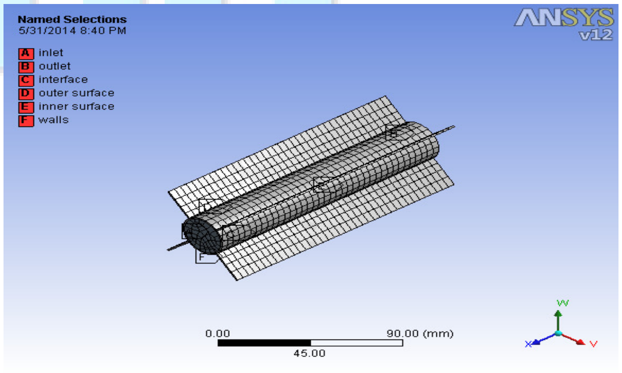

Fig. 1 Meshing And Naming.

The default mesh was done on the models

2.2 Boundary Condition Simulation:

Table 1: Boundary

S.No	*Velocity (M/S)*	*Temperature (K)*
Inner Fluid	**0.01-0.09**	**353**
Outer Fluid	**0.01-0.09**	**353**
Fins		**300**
Wall		**300**

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The basic energy equation model was taken and the laminar flow was assumed. The materials like water and copper was added. The fluid was flow in a velocity of 0.001 to 0.009 m/s and the temperature of 353 K.

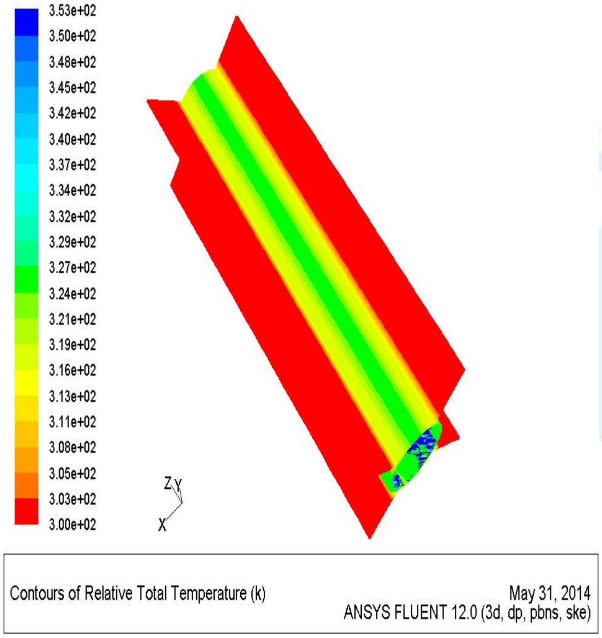

Fig. 2 Simulated

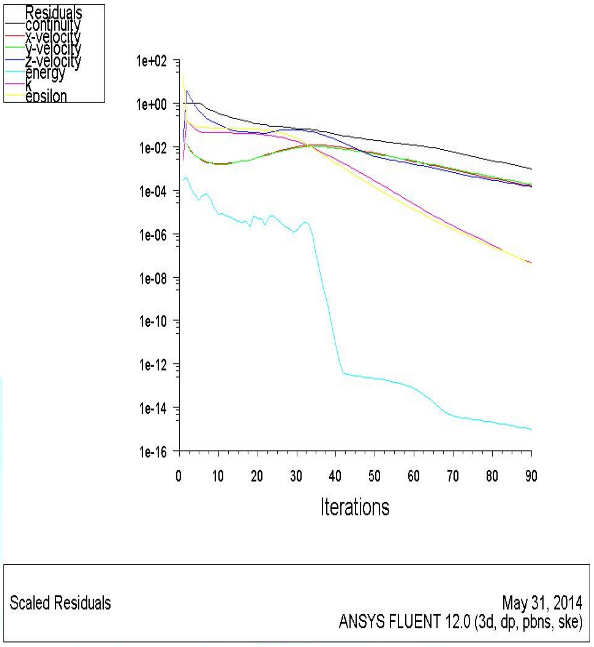

Fig. 3 Iteration

The total heat transfer rate of the models are shown in below table

Table 1: Heat Transfer Rate

Velocity (m/s)	Heat transfer rate (w) Model 1 &	Model 2
0.01	-0.0005996393	-0.0006896698
0.02	-0.0001155544	-0.0001265563
0.03	0.0002607848	0.0002657749
0.04	0.0016074273	0.0016154952
0.05	0.0016143519	0.0016447610
0.06	0.003241776	0.004939976
0.07	-0.0026438778	-0.002599709
0.08	0.0037147392	0.0057637384
0.09	0.019388945	0.0227679890

3. Result and Discussion

At first the water was charged at in the velocity of 0.01 m/s in the temperature of 353 K initially.then the velocity was increased the heat transfer was also increased. The one model has a fin length of 15mm and another one was 20mm fin length. In the model 1 if the velocity increased the heat transfer also increased. Comparing with model 2 the heat transfer rate was high due to the increase in the dimension. The fin length affect the heat transfer increase or decreasing manner. The velocity increased vital role in the increase of heat transfer because of the total heat generation is high in fluid flow. At some velocity the temperature does not increased or decreased that point is stagnate point.

4. Conclusions

In the present work the heat transfer is validated by numerically. In this case the dimension variation and velocity variation truly affect the heat transfer rate. But the effective fin length was only increase the fin efficiency.so I conclude that heat transfer mainly depend upon the dimension of the heat transfer area or shape.

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