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Review Paper On Study of effect of alumina nanoparticles In heat exchanger

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Abstract —*various amount of work has been done to enhance heat transfer in heat exchangers. In the past years researchers have been studying the properties of nano particles of different metal oxides due to their good thermal and electrical conductivity, mechanical flexibility and more. Different types of nano particles used in nano fluid are aluminium oxide, copper oxide, carbon nanotubes etc. The main aim of this project is to study the effect of aluminium oxide's nano particles dispersed in water on twisted tube type shell and tube type heat exchanger*

Keywords-*Nano Particles , Alumina , Heat Transfer Enhancement , Shell And Tube Heat Exchanger , Twisted Tubes*

I. INTRODUCTION

Heat exchangers are devices that provide the transfer of thermal energy between two or more fluids at different temperatures. Shell and tube heat exchangers are the most versatile type of heat exchangers. They are used in the process industries, in conventional and nuclear power stations and they are proposed for many alternative energy applications. The enhancement in heat transfer rate between two or more fluids in heat exchanger is mainly achieved by optimizing the design of heat exchanger and operational parameters.

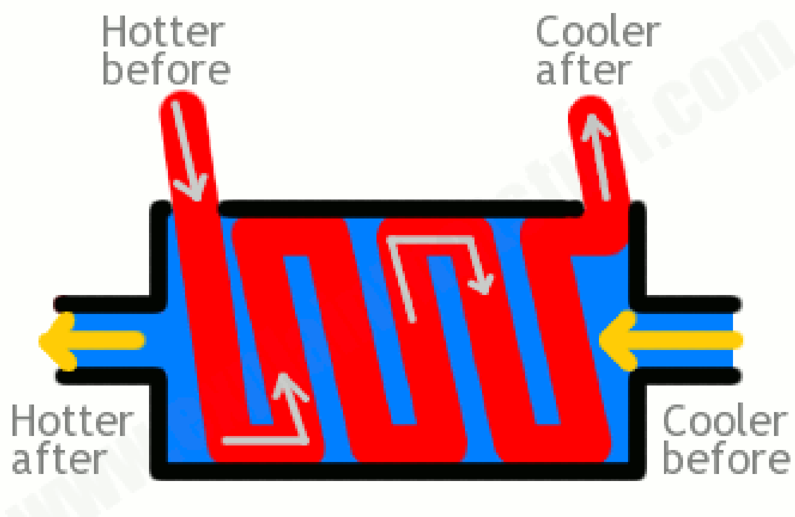

Figure 1. Shell and tube type heat exchanger

Optimizing the operational parameters play a key role in the enhancement of heat transfer rate after the design of heat exchanger. One of the methods is to enhance the thermal conductivity of one of the fluids by incorporating nano-sized particles in the base fluid. Traditional heat transfer fluids such as water, ethylene glycol and oil have inherently low thermal conductivity relative to metals and even metal oxides. Therefore, fluids with suspended solid particles are expected to have better heat transfer properties compared to conventional heat transfer fluids. So far due to associated technological problems, the majority of studies on heat transfer of suspension of metal oxides in fluids were limited to suspensions with millimetre or micron-sized particles. Such large particles may cause severe problems in heat transfer equipment. In particular, large particles tend to quickly settle out of suspension and thereby in passing through micro channels, cause severe clogging and increase in pressure drop considerably. Furthermore, the abrasive actions of the particles cause erosion of components and pipe lines. Modern technology makes it possible to produce ultra-fine metallic or non-metallic particles of nanometre dimensions, which has revolutionized heat transfer enhancement methods. Considering very small particle size and their small volume fraction, problems such as clogging and increased pressure drop have become insignificant for nanofluids. Also the relatively large surface area of nanoparticles increases the stability and reduces the sedimentation of nanoparticles.

II. HISTORY OF NANO FLUID

The twenty-first century is an era of technological advancement and has already seendramatic changes in almost every industry. Nanotechnology is a broad and important area ofresearch and development activity which has been growing explosively, worldwide, in thepast few years. It has the potential for revolutionizing the ways in which materials and products are created and the range and nature of functionalities that can be accessed. Nano-fluid was first suggested by S.U.S. Choi of Argonne National Lab in 1995, it is nothing but the mixture of highly thermal conducting solid particles of less than 50 nm diameter and traditional heat transfer fluid such as water, oil and ethylene glycol.

Figure 2. Nanofluid Particles

It is well known that more dramatic improvement in heat transfer efficiency is expected as a result of decreasing the particle size in a suspension because heat transfer takes place at the surface of the particles

III. LITERATURE REVIEW

Masuda et al. (1993) studied the possibility of altering the properties of conventional heat transfer fluids by suspending submicron particles of water based Aluminium Oxide and Ti02 and reported that the enhancement in the effective thermal conductivities are about 32% and11%, respectively for the nanofluids of 4.3% volume concentration. Eastman et al. (1997) observed that oxide nanoparticles, such as Aluminum Oxide and CuO have excellent dispersion properties in water, oil and ethylene glycol and form stable suspensions. Experimental results indicated higher thermal conductivities in fluid mixture than those of the base fluids and the measured thermal conductivity values are higher for nanofluids and the mixture formula under predicted experimental thermal conductivity of the above nanofluids.

M.A. Khairul presentedthe thermodynamic second law analysis of a helical coil heat exchanger using three different types of nanofluids (e.g. CuO/water, Aluminum Oxide/water and ZnO/water).Amongst the three nanofluids, CuO/water nanofluid, the heat transfer enhancement and reduction of entropy generation rate were obtained about 7.14% and 6.14% respectively. Furthermore, heat transfer coefficient was improved with the increasing of nanoparticles volume concentration and volume flow rate, while entropy generation rate went down.

M.M. Elias studied the effect of different nanoparticle shapes (such as cylindrical, bricks, blades, platelets, and spherical) on the performance of a shell and tube heat exchanger operating with nanofluidanalytically.The results show entropy generation for nanofluids containing cylindrical shaped nanoparticles was higher in comparison with the other nanoparticle shapes and also an increase in both the heat transfer and thermodynamic performance of the system.So cylindrical shaped nanoparticles are recommended to be utilized in heat exchanger systems working with nanofluids.

S.P. Tayalstudiedheat transfer and flow characteristics of a nanofluid consisting of water and different volume concentrations of Aluminium Oxide nanofluid (0.3-2) % flowing in a counter flow horizontal shell and tube heat exchangerThe results show that the convective heat transfer coefficient of nanofluid is slightly higher than that of the base liquid at same mass flow rate and at same inlet temperature. The heat transfer coefficient of the nanofluid increases with an increase in the mass flow rate, also the heat transfer coefficient increases with the increase of the volume concentration of the aluminum Oxidenanofluid.

A.A. RabienatajDarziinvestigated heated helically corrugated tube numerically for pure water and water–alumina nanofluid. The Results show that the heat transfer enhancement is promoted extremely by increasing the volume fraction of nano-particles. Adding 2% and 4% nano-particles by volume to water enhances the heat transfer by 21% and 58%, respectively.

IV. CONCLUSION

`The presence of aluminum Oxide nanoparticles in fluid changes the flow structure so that besides of thermal conductivity increment, chaotic movements, dispersions and fluctuations of nanoparticles especially near the tube wall leads to increase in the energy exchange rates and augments heat transfer rate between the fluid and the tube wall. The increase in heat transfer coefficient due to presence of aluminum Oxide nanoparticles is much higher than the conventional fluids and hence the shell and tube heat exchanger using nanofluid as a coolant has higher heat transfer rate than the conventional shell and tube heat exchanger.

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