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REVIEW OF CONVECTION HEAT TRANSFER AND FLUID FLOW BY NANOFLUID

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ABSTRACT:- Heat transfer enhancement techniques refers to different method used to increase the heat transfer rate, In that Heat Exchanger using different nano fluid. Nano fluid are used in broad range of engineering application due to their increase thermo-physical properties like that Viscosity, thermal conductivity, thermal diffusivity, and convective heat transfer coefficient. The properties change of Nano fluid is depend on the volumetric friction of nanoparticles, shape, and size of the nanoparticle. Nanofluid result from the mixture of base fluid with nanoparticle having dimension of (1-150) nm, with very high thermal conductivities. In this we taking different volume concentration such as (0.1%, 0.2%, 0.5%, 1%, 5%) . the other properties of nano fluid such as its specific heat, density, can be calculated. A review on the experimental works on the specific application of nanofluid is presented.

KEY WORDS: Heat Exchanger, different types of nano fluid, nanoparticle

INTRODUCTION

In a thermal device, improvement of convection heat transfer become an important factor in industries like electronic equipment and heat exchanger. Heat exchanger may be classified according to transfer process, construction, flow arrangement, surface compactness, number of fluid and heat transfer mechanism. Convection heat transfer, often referred to simply as convection, is transfer of heat from one place to another by the movement of fluid. Convection is usually the dominated form of heat transfer in liquid and gases. As metals have higher thermal conductivity compare to fluid, many studies have been made in the past on the thermal behavior of suspended particle matter. Choi[1] and his team develop nanofluids, which is prepared by dispersing nanometer size solid particles in water, ethylene glycol, propylene glycol and they observed increased thermal conductivity values compared to base fluids. These enhanced thermal conductivity values make the use of nanofluids in heat exchange devices highly desirable, at the Argonne national laboratory, USA invented nanometer size suspended in a solution and showed increase of thermal conductivity compare to base fluid. Das et al.[7] have been obtained 2-4 fold enhancement in thermal conductivity in nanofluid in the temperature rang 21-51°C using Al_2O_3 nanofluid. Thermal conductivity of a liquid is an important physical property that decided its heat transfer performance. Conventional heat transfer fluid have inherently poor thermal conductivity which makes them inadequate for ultra high cooling performances. Final observations that the convective heat transfer coefficient of a nanofluid is slightly higher than that of the base liquid at same mass flow rate at same inlet temperature also that heat transfer coefficient increases with the increases of the volume concentration of the Al_2O_3 nanofluid. Eiamsa-ard [18], conducted heat transfer, friction and thermal performance characteristics of CuO /water nanofluid flow in a tube with twisted tape with alternate axis and obtained that, the nusselt number increase upto 12.8 and 7.2 times of the plane tube and further increases to 13.8 with twisted tape insert at 0.7% volume concentration and at Reynolds number of 1990. As we know, thermophysical properties of are imperative parameter in study of heat transfer in fluids, for example, heat transfer is a direct function of thermal conductivity.

Nanofluid Thermophysical properties

In this section, the density, specific heat capacity, effective thermal conductivity and effective viscosity for nanofluid discuss. Some data have been provided on temperature-dependent properties, even though they are only for effective thermal conductivity and dynamic viscosity of the nanofluid. To understand the nanofluid thermophysical properties, and some variable such as nanoparticle volume friction also be discussed.

1.1 Density

Vajjha et al. (6) measured the nanofluid density by using the density meter for liquid and gases. They found a good arrangement between their results and there theoretical equation which was estimated based on the physical principle of the mixture rule. The experimental density of the nanofluid can also be predicted accurately by the mixture law. With the surfactant addition to water, the electrical conductivity was increased significantly while nanofluid density and viscosity are mostly constant.

1.2 Specific heat capacity

The calculation of the effective specific heat of a nanofluid is straightforward. This can be estimated based on the physical principle of the mixture of rule, specific heat capacity is necessary to analyze energy and energy performance. This paper extant different characteristic of specific heat capacity of nanofluid containing preparation and measuring method, effect of volume fraction, temperature, type and size of nanofluid.

1.3 Effective thermal conductivity

Studies regarding the thermal conductivity of nanofluid showed that high enhancement of thermal conductivity can also achieved by using nanofluids. It is possible to obtain thermal conductivity enhancements larger than 20% for a practicle volume fraction smaller than 5%.
From the many experimental results, it is know that the nanofluid effective thermal conductivity and dynamic viscosity depend on many factor such as the nanoparticles thermal conductivity and dynamic viscosity depends on many factors such as nanoparticles thermal conductivity and dynamic viscosity base fluid thermophysical properties nanoparticle shape, volume friction and the operation temperature. Most of the researchers report that increasing the effective thermal conductivity.

1.4 Effective viscosity

Was the first to calculated the effective viscosity of a suspension of spherical solids. By assuming that the disturbance of flow pattern of the matrix base fluids caused by given a given particle does not overlap with the disturbance of flow caused by the presence of a second suspended particle.

Studies on convection heat transfer and fluid flow in Nanofluid
Thermal condition in convection heat transfer, heat include either convection heat transfer with transfer constant temperature or constant heat flux, or both. Working fluid type are either (Al_2o_3+waater), (Sio_2+water) or conventional fluid (air, water, oil, etc)

2.1 Natural convection
Nature convection is a mechanism, or type of heat transport, in which the fluid motion is not generated by any external source (like a fan, pump, suction device, etc)but only density differences in the fluid occurring due to temperature gradient. In natural convection, fluid surrounding a heat source receives heat and by thermal expansion becomes less dense and rises. The surrounding, cooler fluid then move to replace. In engineering application, convection is commonly visualizes in the formation of microstructures during the cooling of molten metals, and fluid flows around shrouded heat-dissipation fins, and solar ponds. A very common industrial application of natural convection is free air cooling without the aid of fin. Studied analytically the free convection boundary-layer flow of a nanofluid past a vertical plates. The effect of thermophoresis and Brownian motion on the Nusselt number investigated. Their finding indicated that the Nusselt number increased when buoyancy-ratio, Brownian motion and thermophoresis parameter increased.

2.2 Forced convection
convection is the one of the heat transfer mode; it is defined as the "energy transfer between the surface and fluid due to temperature difference" and this energy transfer by either forced (external, internal flow). Heat transfer by force convection generally makes used of a fan blower, or pump to provide high velocity fluid either gas or liquid. The high velocity fluid result in a decreased thermal resistance across the boundary layer from the fluid to the heated surface. This, in turn, increases the amount of heat that is carried away by the fluid. The convective heat transfer coefficient strongly depends on the fluid properties and roughness of the solid surface, and type of the fluid flow either laminar or turbulent.

2.3 Mixed convection
Studied numerically the steady mixed convection boundary layer flow past a vertical flat plate embedded in a porous medium saturated by nanofluids. The basic fluid was water and the different types of nanoparticles were Al_2o_3, Cu and Tio_2. The

effect of mixed convection parameter and volume were investigated. The results indicated that the solution had two branches in a certain range of the parameters. The wall of a channel were heated by a uniform heat flux and a constant flow rate was considered throughout the channel. The effect of the peclet number, mixed convection parameter, inclination angle of channel to the horizontal and the volume friction with three different nanofluids type on heat transfer were investigated. Their finding indicated that the heat transfer increased with nanofluids, even for small addition of nanoparticles in the based fluid.

Conclusions

Force convection between hot fluid as water and cold fluid as air, and hence there is scope of research in such heat exchanger:

-The heat transfer coefficient increases by increasing the flow rate, nanofluid temperature and concentration and vibration amplitude.

-The vibration effect increases by increasing the fluid temperature.

-The transfer coefficient at Reynolds number of 10,000 and 22,000 with nanofluid of 0.5%volume concentration for tube flow is higher when compare to water.

-Volume concentration increases the thermal conductivity, density and viscosity of a Nano fluid also increases.

-The particle sizes are decreasing the properties of a nanoparticles improved.

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