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System Design for Natural Circulation Of Heat Exchanger

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***Abstract* - The primary function of a Natural Circulation Loop (NCL) is to transport heat from a source to a sink. The stabilization of loop fluid is achieved with the introduction of nano particles. The fluctuations in the velocity vs time curve would be decrease order and almost become linear with time. The main advantage of the natural circulation system is that the heat transport function is achieved without the aid of any pump.Also the enhancement of flow rate in the loop may be record with the increase of temperature of heat source and also with the increase of volume fraction of Al2O3 in nano fluid. Ultrasonic velocity of a liquid is identified with the coupling powers between the iotas or the molecules.The accurate estimation of thickness, viscosity, ultrasonic velocity and subsequently the determined parameters, free volume and related parameters will give noteworthy data with respect to the state of affairs in an answer.**

***Keywords*- parameters, NCL, nano fluid, viscosity and, ultrasonic velocity.**

I. INTRODUCTION

The motive force for the flow is generated within the loop simply because of the presence of the heat source and the heat sink. Due to this natural circulation loops find several engineering applications in conventional as well as nuclear industries. Notable among these are solar water heaters, transformer cooling, and geothermal power extraction, and nuclear reactor cores. With both the source and sink conditions maintained constant, a steady circulation is expected to be achieved, which can continue indefinitely if, the integrity of the closed loop is maintained. The exploratory and hypothetical examinations have created the data expected to comprehend, anticipate and reenact the conduct of thermosyphons.

The communication of the taking part physical powers is intricate and nonlinear; gravity, contact and latency rely upon heat and mass exchange attributes. This prompts a few fascinating highlights of the convective flows. Natural circulation loops appear in geophysical and geothermal systems and have been used in many applications in diverse energy conversion systems, such as solar heating devices, absorption refrigerators, reboilers in chemical industries and cooling of various engines. One of the most important uses of thermosyphons is in emergency core cooling of nuclear reactors and Natural circulation loops (NCL) are used in a wide field of engineering applications.

1. Nanofluids: Fabrication, Stability,and thermophysical Properties

Fluids of various kinds are normally utilized as heat transporters in heat transfer applications. Such applications where heat transfer fluids (HTF) have a significant job are heat trading systems in control stations, cooling and heating systems in structures, vehicles air conditioning (AC) framework in transportation, and cooling systems of a large portion of the handling plants. In the entirety of the previously mentioned applications, the HTF's thermal conductivity affects the proficiency of the heat transfer process and with it the general productivity of the framework. For such reason, analysts have ceaselessly taken a shot at creating progressed HTFs that have altogether higher thermal conductivities than expectedly utilized fluids.

They likewise stated that the effective thermal conductivity can be expanded by over 20% by including convergence of nanoparticle as low as 1–5 vol% to the basefluid and that the upgrade gets influenced emphatically by the particles shape, particle measurements, and included volume portions in the basefluid, particles thermophysical properties.

II. LITERATURE REVIEW

The exploration take a shot at heat exchanger utilizing nano fluid uses compact heat exchanger as heat moving gadget while Al2O3 as a nano fluid. The impact of the nano fluids on compact heat exchanger is broke down by utilizing 6 – NTU rating numerical technique on turbo-charged diesel motor of type TBD 232V-12 cross stream compact heat exchanger radiator with unmixed fluids comprising of 644 tubes made of brass and 346 nonstop balances made of copper. Near investigation of Al2O3 + water nano fluids as coolant is completed.

1. Heat exchanger using nanofluid in counter flow direction:

Their outcomes show that heat move coefficient was incredibly increased and it relies on factors like Reynolds number, molecule size and shape, and molecule volume division. They likewise found that nanoparticles didn't cause an additional weight drop. Another researcher named Donsheng and Yulog contemplated basically the convective heat move of nanofluid made up of Al2O3-water, moving through a cylinder made up of copper in the laminar stream region and indicated a significant improvement of convective heat move utilizing the nanofluids.

2. Stream Patterns in Liquid-Liquid Mixtures:

Charles et al. (1966) examined the Lockhart and Martinelli parameters; saw to be useful in comparing data for stratified stream of two immiscible fluids in the laminar-violent organization. The curves through fluid data were available with a most extraordinary deviation of 24%. They inspected water-oil mixes in a pipeline, estimated weight drop and stream organizations, and made connections.

III. EXPERIMENTAL PROCEDURE

1. Preparation of Nanofluid

A large variety of combinations of nanostructures and heat transfer fluids can be used to synthesize stable nanofluids with improved thermal transport properties. Nanostructures made from metals, oxides, carbides and carbon nanotubes can be dispersed into HTFs such as water, ethylene glycol, hydrocarbons and fluorocarbons with or without the presence of stabilizing agents.

In most experimental studies, nanofluids are synthesized in a two-step process, which is the first and the most classic synthesis method of nanofluids. The major problem is that agglomeration of nanoparticles may occur. When finely divided solid nanostructures are immersed in liquids, they often do not form a stable dispersion. Many of the particles aggregate together in forms of clumps. Though these particles can be easily re-dispersed in liquids by mechanical dispersion, they soon clump together again to form large aggregates that will settle out of the suspension quickly.

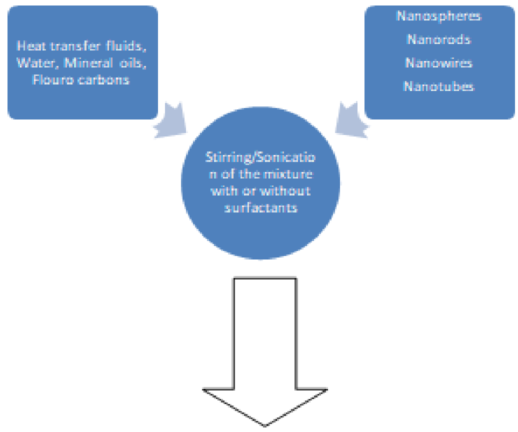

Fig.1. Two step method for nanofluids production.

1. Characterization of Nanoparticles

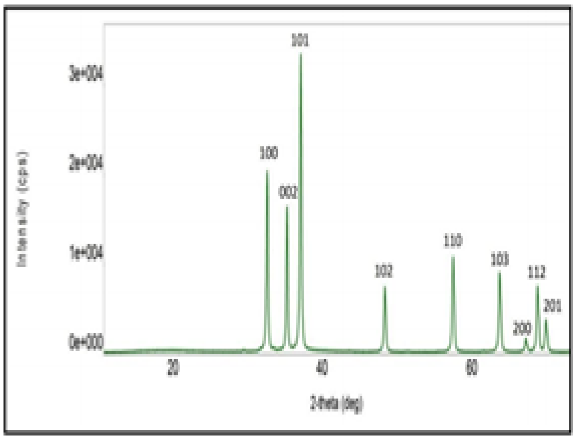

Fig.2.XRD patterns of ZnO nanoparticles.

IV. INSTRUMENTS/EQUIPMENT USED

In the experiment carried out, the important devices used are Purge Rotameters, Ultrasonic flow meter, Data logger, PT100 sensors. Purge rot meters provide an economical means of flow rate indication. Designed for applications where accuracy requirements are not severe, these instruments are ideal for such services as purging, seal oil systems, bearing lubrication, and cooling water flow indication.

Fig.3. Constant temperature water supply bath.

Fig.4. Probe Sonicator.

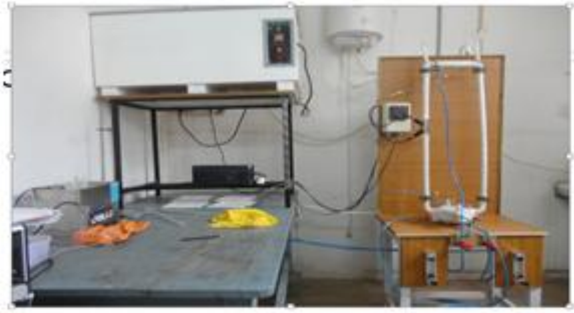

Fig.5. Experimental Setup.

Table I: Attenuation coefficient of various nanofluids of ZnO in 10% aqueous hexylene glycol at different temperatures.

Conc.(wt%)	Attenuation coefficient ($\alpha/f^2 \times 10^{-14}$) ($s^2\ m^{-1}$)		
	303.15 K	308.15 K	313.15 K
0	7.51119	6.64545	5.79328
0.02	7.80619	6.90955	6.06528
0.04	7.93957	7.04718	6.18824
0.06	7.88783	6.99140	6.13432
0.08	7.75135	6.86269	6.02056
0.10	7.81362	6.97932	6.09036

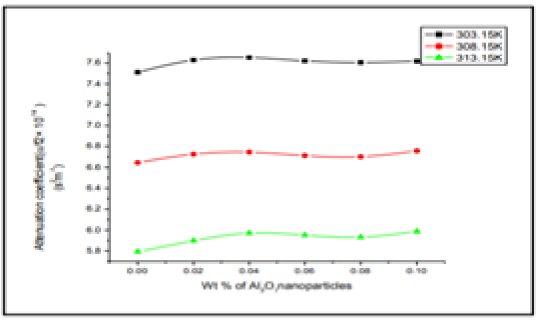

Fig. 1 Plots of attenuation coefficient of various nanofluids of ZnO in 10% aqueous hexylene glycol at different temperatures.

V. CONCLUSION

The trends of variety of different acoustic and thermodynamic parameters at three distinct temperatures 303.15 K, 308.15 K and 313.15 K with increment in centralization of Al2O3 nanoparticles in three diverse base fluids i.e., in 10% watery hexylene glycol are accounted. In the present work, Al2O3 nanoparticles have been blended by various methods. These orchestrated nanoparticles were then portrayed by utilizing different systems like X-ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX).

Nanofluids of different fixations have been set up from these orchestrated nanoparticles in three diverse base fluids, which were 10% watery arrangements of ethylene glycol, propylene glycol and hexylene glycol with the assistance of ultrasonicator. Thickness, viscosity and ultrasonic velocity at 5 MHz were resolved for these nanofluids at three distinct temperatures.

REFERENCES

[1]. Walter Borreani et al "Assessment of a 2D CFD model for a single phase natural circulation loop" International journal of heat and technology Vol. 35, Special Issue 1, September 2017, pp. S300-S306
[2]. M. O. Oni, Combined effect of heat source, porosity and thermal radiation on mixed convection flow in a vertical annulus: An exact solution, Engineering Science and Technology, an International Journal, Vol. 20, pp. 518–527, (2017)
[3]. E. Abedini, T. Zarei, H. Rajabnia, R. Kalbasia and M. Afrand, Numerical investigation of vapor volume fraction in subcooled flow boiling of a nanofluid, Journal of Molecular Liquids, Vol. 238, pp. 281–289, (2017)
[4]. V Diah Hidayanti Sukarno (2017) "Challenges for nanofluid applications in heat transfer technology" IOP Publishing doi:10.1088/1742-6596/795/1/012020 Journal of Physics: Conf. Series 795 (2017) 012020
[5]. M. Vishnu Narayanan "Nanofluids: A Review on Current Scenario and Future prospective" International Conference on Mechanical, Materials and Renewable Energy, IOP Conf. Series: Materials Science and Engineering 377 (2018) 012084 doi:10.1088/1757-899X/377/1/012084