RESEARCH IN DEVELOPING THE PHOTONIC SINTERING TECHNIQUES FOR NANO TUBES

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ABSTRACT

Photonic sintering is a low ADVANCED MANUFATURING SYSTEMS introduction sintering technique created to sinter nanoparticle slim movies. The procedure includes utilizing a xenon streak light to convey a high power, brief span (< 1 ms), beat of light to the saved nanoparticles. Photonic sintering was created by Nanotechnologies (presently NovaCentrix) of Austin, Texas, and was first made open in 2006 (Schroder et al., 2006). As photonic sintering is another innovation it is otherwise called beat ADVANCED MANUFATURING SYSTEMS handling (PTP) (Camm et al., 2006) and exceptional beat light (IPL) sintering (Kim et al., 2009). Conductive meager movies made out of nanoparticle affidavits, when presented to a short beat of high power light, are changed into useful printed circuits.

INTRODUCTION

Photonic sintering is a low ADVANCED MANUFATURING SYSTEMS presentation sintering strategy created to sinternanoparticle slim movies. The procedure includes utilizing a xenon streak light to convey a highintensity, brief length (< 1 ms), beat of light to the kept nanoparticles. Photonic sintering was created by Nanotechnologies (presently NovaCentrix) of Austin, Texas, and was first made open in 2006 (Schroder et al., 2006). As photonic sintering is another innovation it is otherwise called beat ADVANCED MANUFATURING SYSTEMS handling (PTP) (Camm et al., 2006) and extraordinary beat light (IPL) sintering (Kim et al., 2009). Conductive meager movies made out of nanoparticle testimonies, when presented to a short beat of high force light, are changed intofunctional printed circuits. The printed circuits can be custom fitted for use as adaptable circuit sheets, RFID labels, level board shows (Carter and Sears, 2007), photovoltaics, smart packaging (Novacentrix, 2009). One of the essential favorable circumstances of the technique is that the high power beat of light creates insignificant harm on low temperature substrates. This permits the nanoparticles to be stored and restored on a high assortment of low temperature substrates, for example, fabric, paper, and Mylar (Carter and Sears, 2007; Farnsworth, 2009). Another bit of leeway of utilizing photonic relieving is the speed at which nanoparticle affidavits can be sintered. As opposed to going through hours in a broiler or programming a laser to pursue the testimony way, the photonic restoring procedure can sinter enormous zones (~ 200 cm2 per 10 cm long light) in < 2 ms (Novacentrix 2009).

1.1 One of the fundamental goals of the work announced here was to decide the viability of photonic sintering of silver nanoparticle testimonies. This was finished by estimating the densification of silver nanoparticles films following photonic sintering. The retention of light produced by a glimmer light for changing thicknesses of silver nanoparticle layers was additionally estimated. To decide the sum and profundity of sintering, SEM pictures were taken of a cross segment of a sintered film. To more readily comprehend the procedure through which the nanoparticles are sintered, we figure the retention of the light produced by the glimmer light by the silver nanoparticle film utilizing the Bruggeman viable medium hypothesis. Utilizing the warmth move programming bundle Fluent™ to demonstrate the temperature profile of the movies during and following sintering, we propose a model for the photonic procedure.

PHOTONICSINTERING OVERVIEW:

Photonic sintering was first presented at the 2006 NSTI Nanotechnology Conference andTrade Show (Schroder et al., 2006). It was created by NovaCentrix for the reason ofrapidly sintering metal nanoparticle based movies (Schroder et al., 2006). The innovation permits the nanoparticles to sinter without essentially raising the temperature of the substrate. This is cultivated by utilizing a glimmer light. Two fundamental parameters control the level of sintering: the force of the light and the span of the light heartbeat. The glimmer light is held between 0.5 cm to 20 cm over the testimony and an extraordinary current is gone through the blaze light (Novacentrix, 2007). Because of this extraordinary current, the xenon streak light issues a high power, expansive range beat of light. This beat of light is consumed by the nanoparticles, which warms them to such an extent, that they sinter into a solitary part.

Subsequent to watching the correlations with conventional sintering techniques, tests were raced to pick up knowledge into the procedure by which particles are sintered during photonic restoring. The densification as an element of the glimmer light voltage and heartbeat length was estimated to decide the impacts of those parameters. Affidavits of fluctuating thickness were tried utilizing an UV-Vis spectrometer to gauge the assimilation of the statements in the wavelength locale created by the glimmer light. At last, SEM pictures were taken of the cross segment of a thick sintered example To decide the profundity and measure of sintering in the statement.

1.2 PARAMETRIC STUDY OF DENSIFICATION:

We estimated the densification of silver nanoparticles as an element of the beat span and blaze light voltage to locate the ideal settings to sinter V2 silver ink. The V2 silver ink comprises of Novacentrix 25 nm silver nanoparticles suspended in DMA. The estimations additionally permit an assurance of the impact of light voltage and heartbeat term on the sintering procedure.

The way toward estimating the densification started by finding the volume division of nanoparticles in the testimony before sintering. This was cultivated by gauging a perfect glass slide and afterward keeping V2 ink in a square example on the slide. The thickness of the statement was then estimated utilizing a Zeiss Imager M1M magnifying instrument. The testimony thickness was dictated by concentrating on the outside of the glass slide and afterward again on the outside of the statement. The central separations were then contrasted with discover the thickness of the statement.

Figure 1.1 Optical cross section of the V2 silver on a glass slide in an epoxy mold.

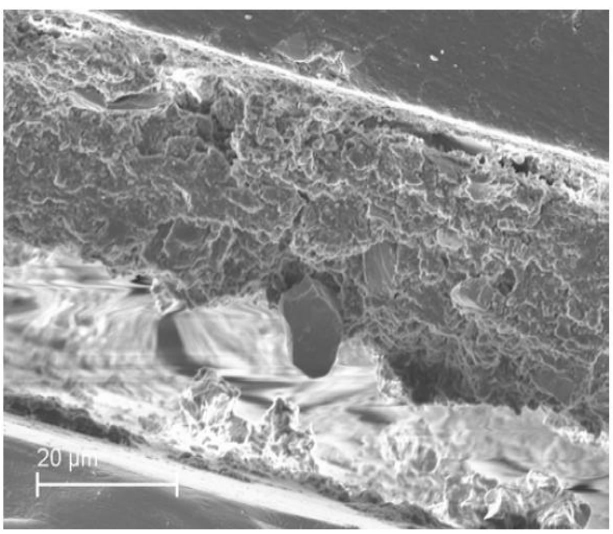
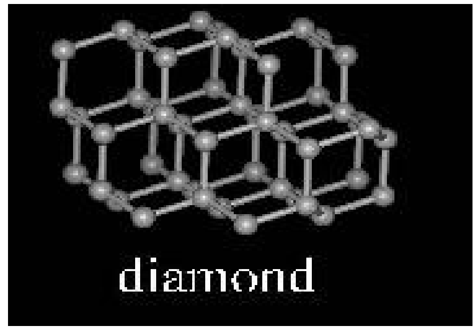


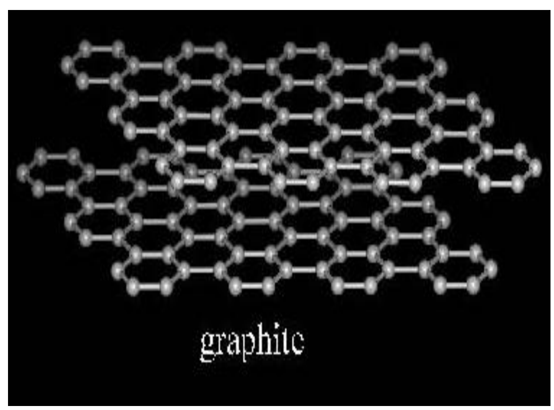
Figure 1.2 SEM image of silver deposition cross section.

BACKGROUND LEADING UP TO PHOTINIC SINTERING:

Until the mid-1980's pure solid carbon was thought to exist in only two physical forms, diamond and graphite. Diamond and graphite have different physical structures and properties however their atoms are both arranged in covalently bonded networks. These two different physical forms of carbon atoms are called allotropes.



Even though diamond and graphite are made of the same carbon atoms, they obviously have different physical properties. Diamond is very hard and graphite is very soft. Use the two pictures to help you explain why this difference occurs.



Graphite is composed of graphene sheets of carbon atoms. This is the material that is in our "lead"

LITERTURE REVIEW:

Warmth move assumes a significant job in various applications. For instance, in vehicles, heat produced by the prime mover should be evacuated for appropriate activity. Also, electronic types of gear disseminate heat, which requires a cooling framework. Warming, ventilating, and cooling frameworks additionally incorporate different warmth move forms. Warmth move is the key procedure in ADVANCED MANUFATURING SYSTEMS control stations. Notwithstanding these, numerous generation forms incorporate warmth move in different structures; it may be the cooling of a machine apparatus, sanitization of nourishment, or the temperature change for setting off a synthetic procedure. In the majority of these applications, heat move is acknowledged through some warmth move gadgets, for example, heat exchangers, evaporators, condensers, and warmth sinks. Expanding the warmth move effectiveness of these gadgets is alluring, in light of the fact that by expanding productivity, the space involved by the gadget can be limited, which is significant for applications with minimization prerequisites. Besides, in the majority of the warmth move frameworks, the working liquid is circled by a siphon, and enhancements in heat move effectiveness can limit the related power utilization.

There are a few strategies to improve the warmth move effectiveness. A few techniques are use of broadened surfaces, utilization of vibration to the warmth move surfaces, and use of funnels. Warmth move proficiency can likewise be improved by expanding the ADVANCED MANUFATURING SYSTEMS conductivity of the working liquid. Normally utilized warmth move liquids, for example, water, ethylene glycol, and motor oil have moderately low ADVANCED MANUFATURING SYSTEMS conductivities, when contrasted with the ADVANCED MANUFATURING SYSTEMS conductivity of solids. High ADVANCED MANUFATURING SYSTEMS conductivity of solids can be utilized to expand the ADVANCED MANUFATURING SYSTEMS conductivity of a liquid by adding little strong particles to that liquid. The attainability of the use of such suspensions of strong particles with sizes on the request for millimeters or micrometers was recently explored by a few specialists and noteworthy disadvantages were watched. These disadvantages are sedimentation of particles, stopping up of diverts and disintegration in channel dividers, which averted the down to earth utilization of suspensions of strong particles in base liquids as cutting edge working liquids in heat move applications [1, 2].

To get higher warmth move properties, various hypothetical and test investigations of the compelling ADVANCED MANUFATURING SYSTEMS conductivity of strong molecule suspensions have been directed gone back to the great work of Maxwell (1873).

Ahuja 1975, Liu et al. 1988]. Albeit such suspensions show higher warmth move properties, they experience the ill effects of security issues. Specifically, particles will in general settle down rapidly and in this manner causing serious obstructing. Choi, in

1991, built up a channel heat exchanger where small scale measured particles suspended in fluids were utilized for cooling. It indicated brilliant warmth move conduct yet at a significant expense of siphoning power.

Masuda et al.(1993) just because showed that the ADVANCED MANUFATURING SYSTEMS conductivity of ultra fine suspensions of alumina, silica and different oxides in water expanded by up to 30% for a volume part of 4.3%.

In 1995, Choi [Choi 1995] revealed a probability of multiplying convection heat move coefficients by utilizing nanoparticles suspended in fluids, an outcome that would somehow or another require a ten times increment in siphoning power.

This new class of nanotechnology based warmth move liquids that display ADVANCED MANUFATURING SYSTEMS properties better than those of their host liquids were named as nanofluids.

In this way, nanofluids are designed by suspending nanoparticles with normal sizes underneath 100nm in conventional warmth move liquids, for example, water, ethylene glycol and oil.

Table 2.1 ADVANCED MANUFATURING SYSTEMS conductivities of various materials

Material	Thermal conductivity at room temperature (W/m-K)
Silver	429
Copper	401
Aluminum	237
Diamond	3300
Silicon	148
Alumina	40
Water	0.61
Ethylene glycol	0.25
Motor oil	0.15

SIMULATION OF SINGLE PHASE FLUID FLOW

It is well known that nanoparticles have very high ADVANCED MANUFATURING SYSTEMS conductivity compared to commonly used coolant. Thus, the ADVANCED MANUFATURING SYSTEMS conductivity and other fluid properties are changed by mixing the particle in fluid. The changed properties of the nanofluids determine the heat transfer performance of the straightpipe with nanofluids. This point is illustrated in this chapter by doing the computational fluid dynamics (CFD) analysis of the hydrodynamics and ADVANCED MANUFATURING SYSTEMSbehaviour of the single phase flow through a circular Pipe (Lee and Mudawar, 2007).

SPECIFICATION OF PROBLEM

Consider a steady state fluid flowing through a circular pipe of constant cross section as shown in Fig. 3.The diameter and length of circular channel are 0.014 m and 1.7 m respectively. The inlet velocity is *u* (m/s), which is constant over the inlet cross-section. The fluid exhausts into the ambient atmosphere which is at a pressure of 1 atm.

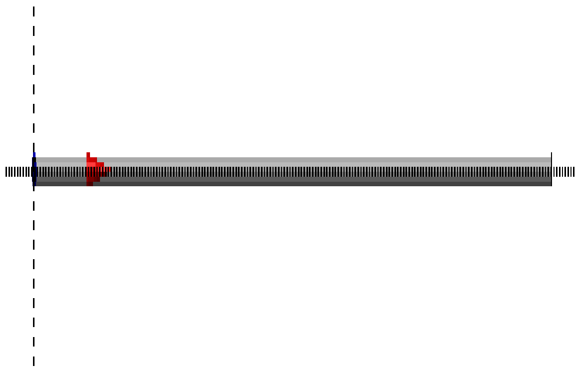


Figure 3 circular pipe geometry

As fluid flows through in a pipe at both hydraulic and ADVANCED MANUFATURING SYSTEMSly fully developedcondition, the Nusselt number is constant for laminar flow and it follows the Dittius-Boelter equation for turbulent flow.

MESHING OF GEOMETRY:

Structured meshing method done in ANSYS Workbench was used for meshing thegeometry. Nodes were created. The 2D geometry of circular channel withstructured mesh is shown in Fig. 4.

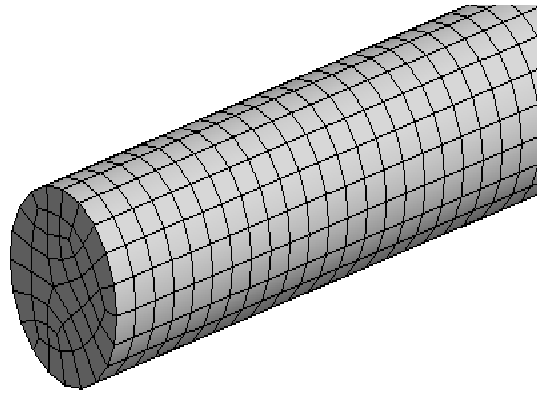


Figure 4:Meshed model of pipe with zoomed view

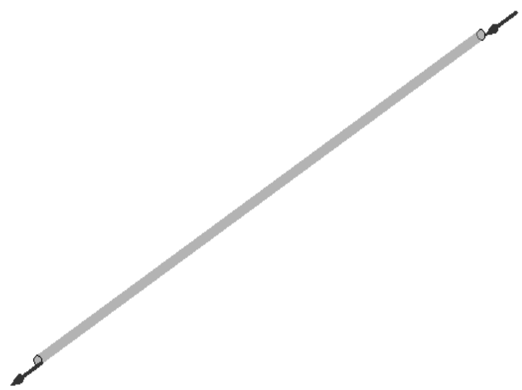


Figure 5 Boundary conditions

RESULTS AND DISCUSSION:

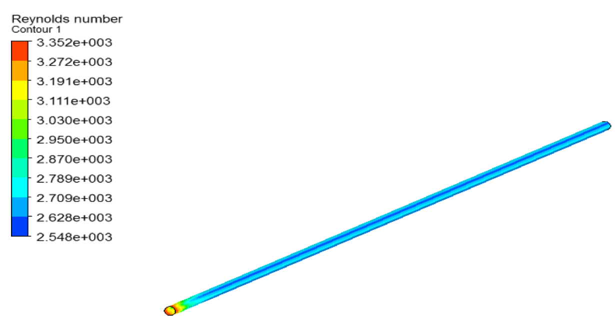


Figure 5.1 of Nano tube with pure water flow

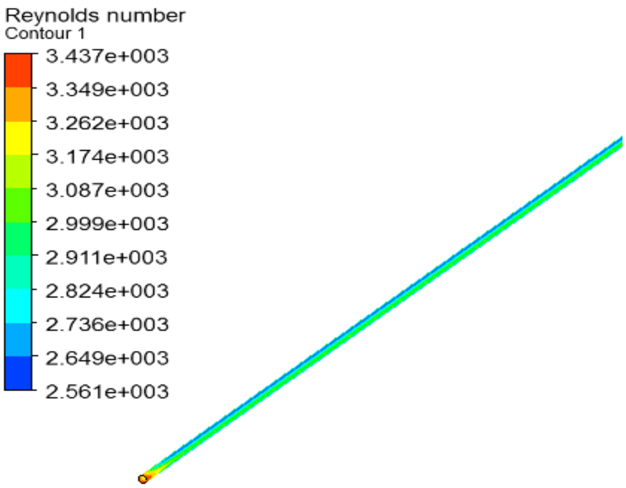


Figure 5.2 of Nano tube with pure 0.01% Nano fluid

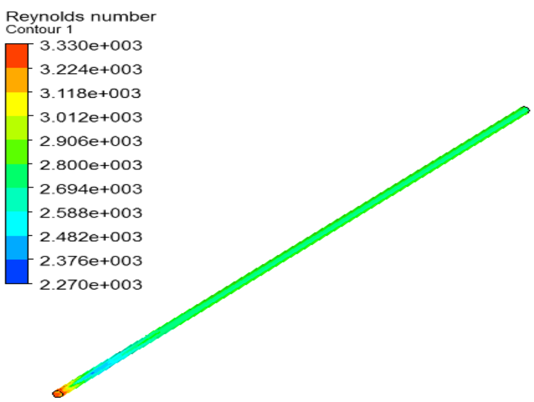


Figure 5.3 of Nano tube with pure 0.02% Nano fluid

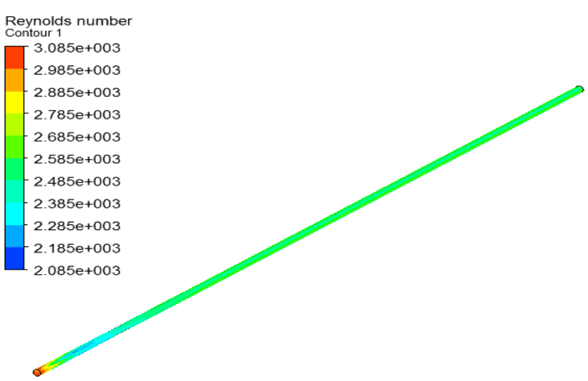


Figure 5.4 of Nano tube with pure 0.03% Nano fluid

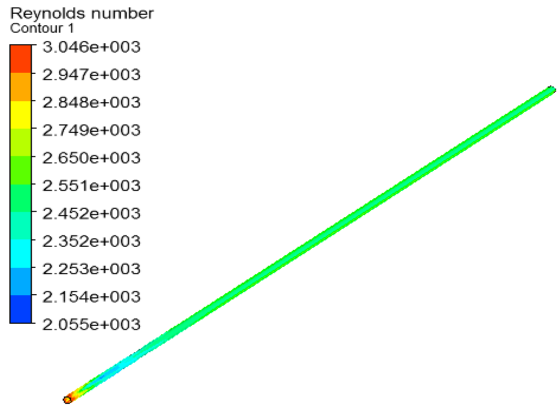
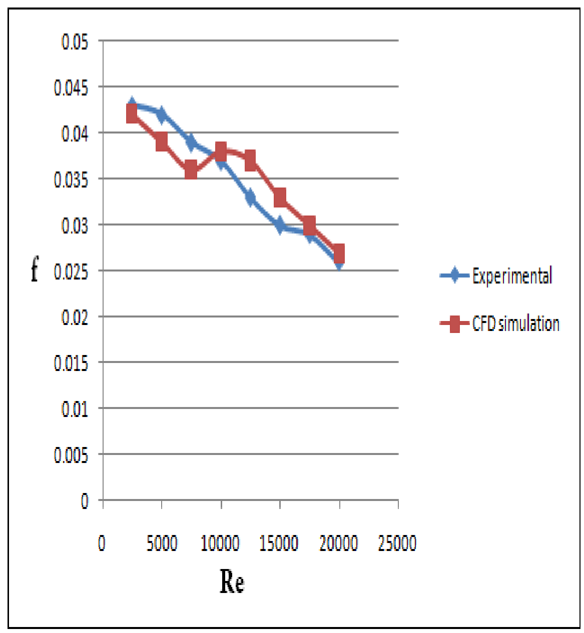
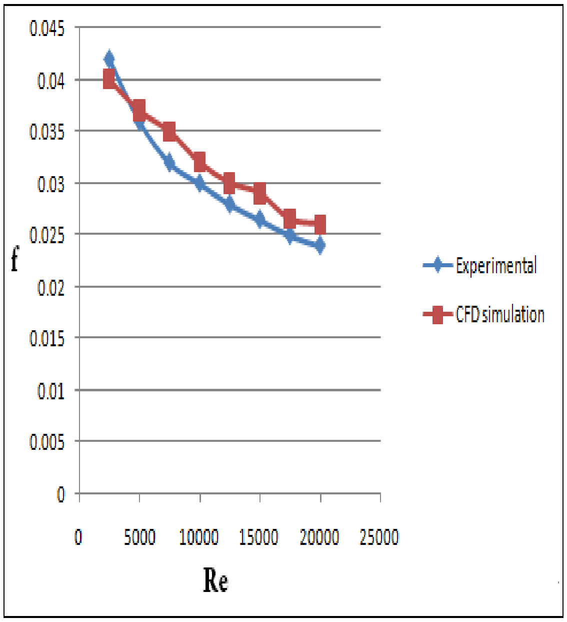


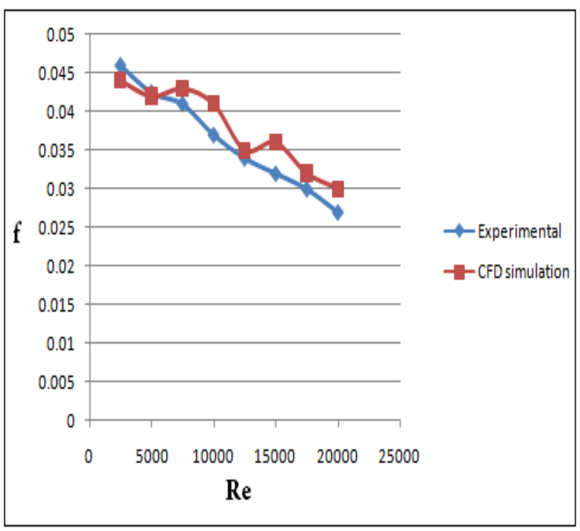
Figure 5.5 of Nano tube with pure 0.02% Nano fluid



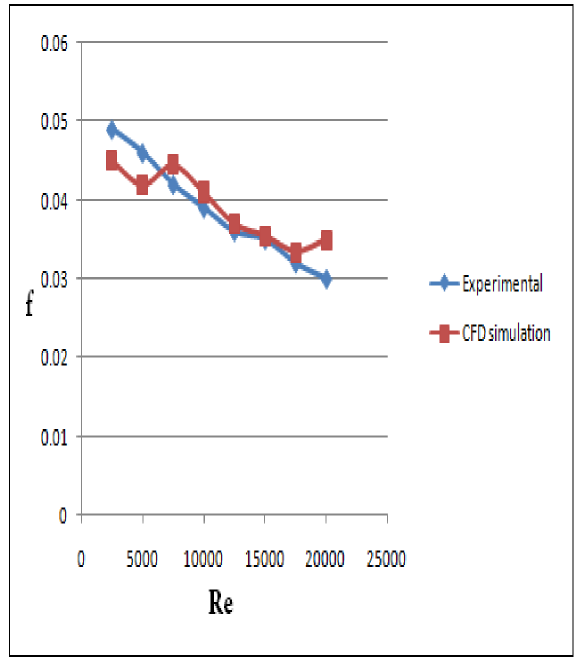
Graph 5.1 flow rate with 0.1% nanaofluid



Graph 5.2 flow rates with 0.2% Nano fluid



Graph 5.3 flow rates with 0.3% Nano fluid



Graph 5.4 flow rates with 0.6% Nano fluid

CONCLUSION:

In this project, the heat transfer coefficient in the developed region of pipe flow containing Fe_3O_4-water nanofluid during the constant heat flux was simulated using CFD. The focal point of investigation was to evaluate the effect of particle volume concentration on convective heat transfer characteristics in the developed region of the tube flow containing water-Fe_3O_4nanofluid. It was observed that 0.6% of nanofluids showed highest heat transfer characteristics than that of the base fluid (water).

In this work the hydrodynamics and ADVANCED MANUFATURING SYSTEMS behavior of circular pipe were studied. Pure water and its nanofluids (Fe_3O_4) were considered in pipe channel. A steady state computational fluid dynamics (CFD) models was simulated by ANSYS Fluent 13.0 here. The effect of Reynolds number and Nusselt number on the flow behavior of the pipe was studied.

A numerical study of single phase fluid flow in a pipe was discussed. Water is used s a base fluid and its nanofluids are used as fluid medium. Key conclusion of this chapter can be summarized as follows.

- The computational results successfully validated the analytical data for circular pipe channel.
- Heat transfer coefficient is constant throughout the circular channel due to its fully developed conditions
- As the concentration of nanoparticle increases heat transfer coefficient also increases, with the increase in Nusselt number
- Wall temperature increase within the flow direction of circular channel at very low Re simulation of Single Phase Fluid Flow in a Circular channel
- Wall temperature has negligible variation for higher Reynolds number.

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