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A Review on Zinc Oxide Nano Fluids

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A B S T R A C T

Double pipe heat exchangers are used for low heat duty applications. In order to use them for heavy duty applications, they present limitations. In order to use double pipe heat exchanger for heavy duty applications, there is a necessity for enhancement of heat transfer in the heat exchanger. In order to augment the rate of heat transfer and to improve the performance of a double pipe heat exchanger in this work it is aimed to use ZnO/water based Nano fluids and twisted tubes. In this work the focus is to determine Nusselt number, friction factor, performance evaluation criteria and thermal performance factor to analyze the performance of a double pipe heat exchanger circulated with ZnO/water based Nano fluids inside the spiral tubes of a double pipe heat exchanger.

1. INTRODUCTION:

Nano fluids can be considered as the future of heat transfer fluids in various heat transfer applications. They are expected to give better thermal performance than conventional fluids due to the presence of suspended nanoparticles which have high thermal conductivity. Lately, there have been numerous investigations that have revealed the enhancement of thermal conductivity and higher heat transfer rate of Nano fluids. Significant enhancement in the heat transfer rate with the use of various Nano fluids in various application compared to conventional fluids have been reported by several researchers. The average size of nanoparticles is below 100 nm. The term “Nano fluid” was coined by Choi in the year 1995 to describe a new class of nanotechnology based fluids that showcases tremendous thermal properties than what the base fluids shows. They have a size less than 100nm which makes the nanoparticles dissolve easily inside the base fluid and makes sure that there is no erosion and clogging in the fluid. These fluids contain a few amount of atoms and possess properties which significantly vary from their original form’s properties. They are a new class in engineering materials which provide applications in various fluid type systems such as lubricant fluids, heat transfer fluids and magnetic fluids..

MATERIAL DETAILS:

- Zinc Oxide Nano powder
- Surfactant (Sodium Lauryl Sulphate)
- Demineralized water
- Magnetic stirrer
- Magnetic beeds

TESTING ANALYSIS:

- XRD(X-ray diffraction)
- SEM(Scanning Electron Microscopy)
- CFD(Computational Fluid Dynamics)
- Thermo-physical properties

PREPARATION OF NANOFLUIDS:

In this paper, we are going to know about the preparation and characterization of ZnO nanoparticles by calculating the weight of surfactant and ZnO nanoparticles using reference equation and doing several analysis like SEM, XRD and CFD.

First we need the calculations regarding how much quantity of Nano powder is required at different concentrations (i.e. 0.1%, 0.3%, 0.5%). Based on concentrations result, we need to measure the surfactant by $1/10^{th}$ of zinc oxide concentration. Now pour demineralized water in a beaker then add single

concentration of surfactant to it and mix well. The surfactant dissolves in demineralized water .After dissolve of surfactant, add one concentration of ZnO Nano powder and place the beaker on magnetic stirrer for minimum of 6hrs.Nano fluid is prepared. Now perform SEM and XRD analysis tests on this Nano fluid.

SEM (Scanning Electron Microscope) analysis:

SEM stands for Scanning Electron Microscope which provides information on size and shape of a Nano particle.

XRD (X-Ray Diffraction) analysis:

XRD stands for X-ray diffraction which provides structure of the Nano particle.

Thermo-physical properties:

We perform thermo-physical properties tests like viscosity, density, specific heat, thermal conductivity and thermal resistivity.

FUTURE SCOPE:

- Recent advances in Zinc Oxide Nanoparticles for Cancer diagnosis, target Drug delicious and treatment.
- Alcohol Sensor technology is one of the most significant technology for the future with a constantly growing number of applications ranging from toxic gas detection manufacturing process.
- Now a days, there are many critical concerns in the Agricultural sector .Including reduced productivity of plans due to various Environmental Factors.
- Size dependent Bacterial Growth inhibition and Antibacterial activity of AG doped ZNO Nanoparticle under different atmosphere conditions.

RESULTS:

SEM Analysis

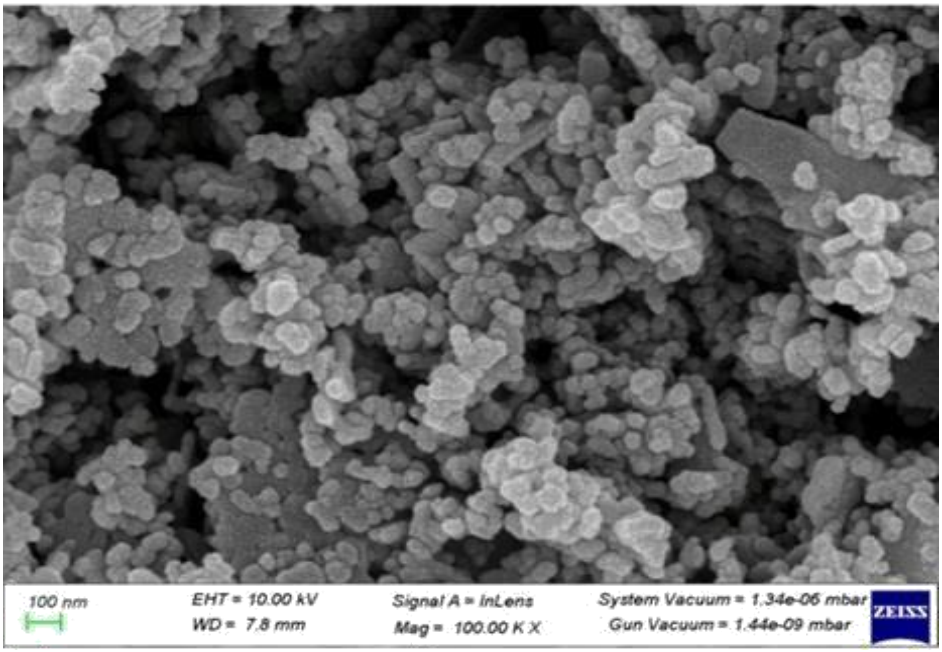

Fig 1:SEM image at 100kx magnification

XRD Analysis

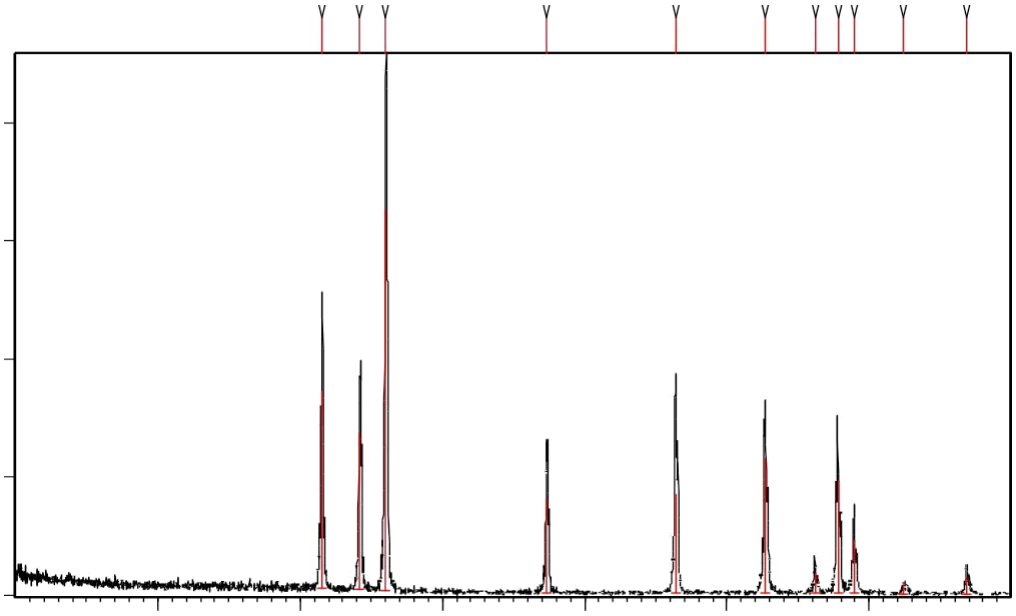

Fig 2:XRD image

CONCLUSIONS:

- Procurement of Nano particles is done by calculating the weight of Zinc Oxide Nano particle and surfactant.
- Using magnetic stirrer the Nano particle is stirred efficiently.
- Analysis (SEM and XRD) are performed on the procured Nano powder to analyze the powder size and quality.
- Thermo-physical properties are also performed on Nano fluid.
- Zinc Oxide Nano fluid is in Hexagonal Wurtzite structure.
- Thermal resistivity in Nano fluids is lower than base fluid by almost by 45%.

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