"Synthesis and Electrical and Acoustic Characterization of CuO Nano fluids"

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Abstract

There are large number of applications of metal oxide nano fluids. In this research paper CuO nanofluids are synthesized by chemical method [1, 3]. The average particle size obtained is about 18 nano meter, when measured in fluid form at room temperature. Different weight percentage nano fluids are then prepared and their electrical and acoustic characteristics are observed. It was found that electrical conductivity increases with increase in weight percentage of CuO in base solutions while ultrasonic sound velocity remains more or less constant. The solution remains suspended form for over one month and particle size is analyzed after that, which showed very good formation of stable nano fluid.

KEYWORDS: Nano Fluids, Electrical and Acoustic characteristics.

Introduction:

Definition: A **Nanofluid** is a fluid containing nanometer-sized particles, called nanoparticles. These fluids are engineered colloidal suspensions of nanoparticles in a base fluid.

The nanoparticles used in nanofluids are typically made of metals, oxides, carbides, or carbon nanotubes. Common base fluids include water, ethylene glycol and oil.

Nanofluids [5] are fundamentally characterized by the fact that Brownian agitation overcomes any settling motion due to gravity. Thus, a stable nanofluid is theoretically possible as long as particles stay small enough (usually <100 nm). Maintaining this size, however, can be a challenge since particles frequently come into contact with each other—potentially leading to the formation of large particle agglomerates which can settle out of suspension. The term "nanofluid" also indicates a mixture where the properties of both the nanoparticles and the base fluid contribute to the application. In this sense, a nanofluid is created when nanoparticles are controllably dispersed into a base fluid to enhance its properties.

The main purpose of this research project thus is the synthesis of metal oxide nanofluids and to find its heat transfer applications and acoustic parameters, as it measures adiabatic compressibility [11]. Heat transfer and propagation of sound are the characteristics of medium only, thus possible relation between heat capacity and adiabatic compressibility also can be checked.

Objectives:

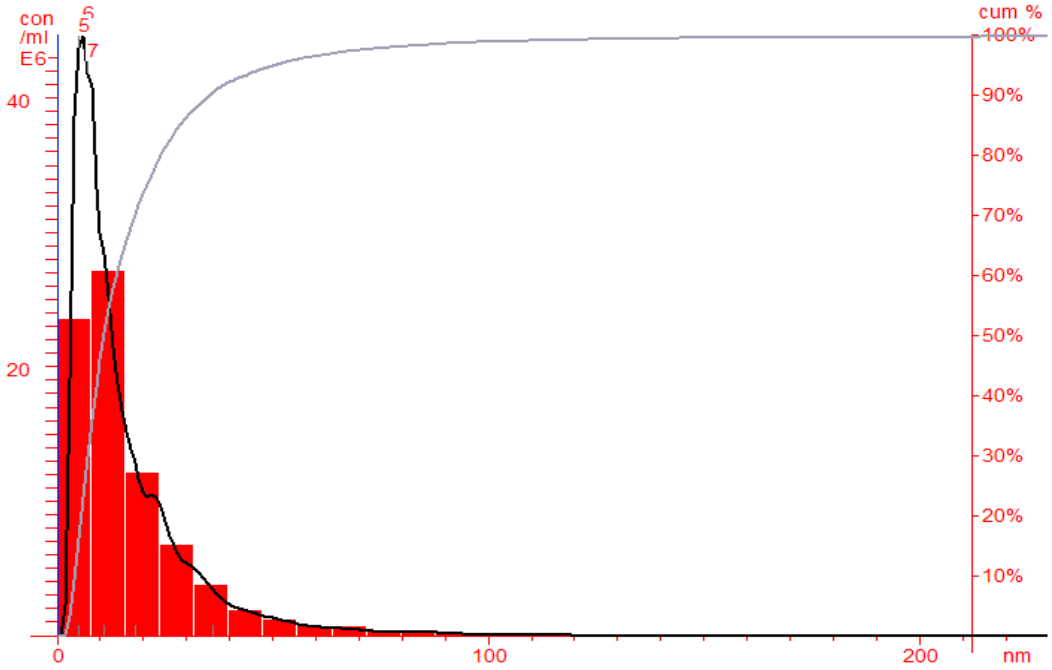
Following objectives were made for this research:

1) Synthesis of CuO Nano fluid using Chemical Method.
2) Electrical Characterization of Nano Fluid for various weight percentages.
3) Acoustic Characterization of Nano Fluid for various weight percentages.

Experimental Details:

1) The synthesis of CuO nanofluid is done by chemical method [3,5]. The desired amount of copper acetate solution is used as a base liquid and little amount of glacial acetic acid is added. The solution is allowed to boil and after that 8M NaOH solution is added which turns the colour of solution from blue to dark brown. The solution is required to be heated for 4 hours with precaution that it did not boiled. Magnetic stirring is continuously expected. The mixture of chemicals is centrifuged and washed with distilled water. It is expected that solutions can be made in distilled water with preferably weight percentage of more than two.
2) The electrical conductivity is measured with the help of conductivity meter having least count of 0.001 mille-Siemens.
3) The velocity of ultrasonic sound can be measured with the help of Ultrasonic Interferometer working at 1 Mega Hertz and having least count of 0.001 cm.

Particle size profile:

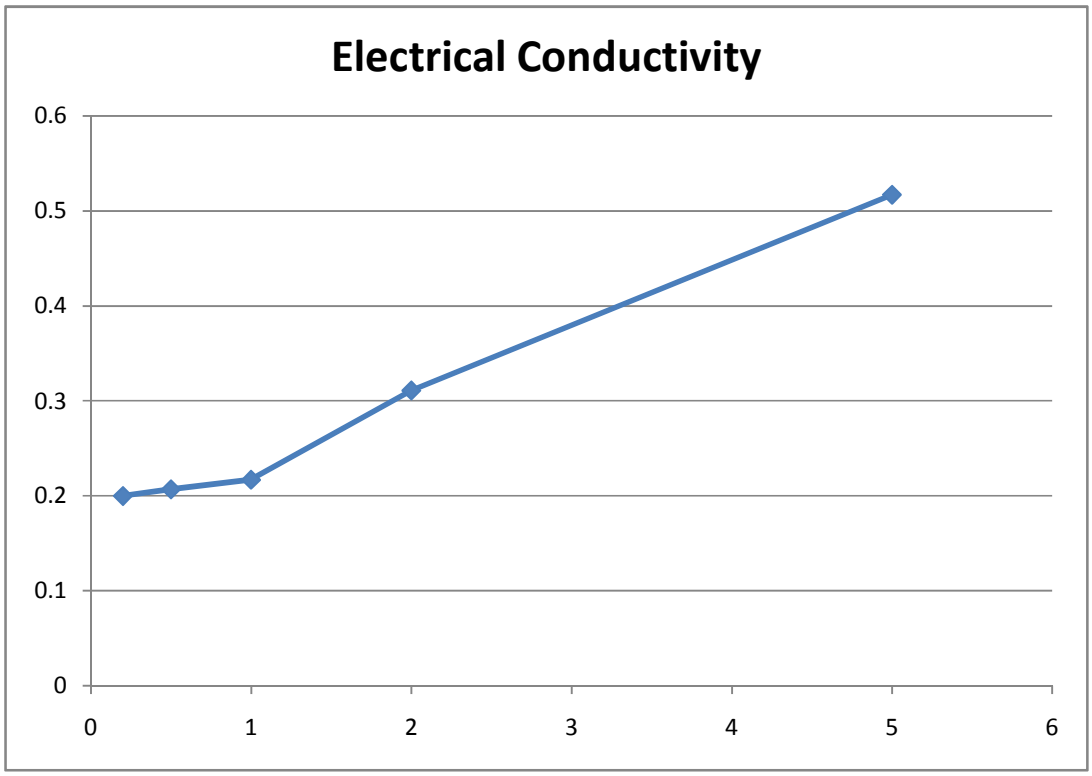


Size Distribution: Mean: 18 nm, Mode: 6 nm, SD: 24 nm. Drift Velocity: 2026 nm/s

Electrical Measurements:

CuO Nf wt%	Electrical Conductivity
0.2	0.2
0.5	0.207
1	0.217

2	0.311
5	0.517



Acoustic Measurements:

The velocity of sound in water is found to be 1480 m/sec, while in CuO Nano Fluid it was found to be around 1520 m/sec.

Result and Conclusions:

1) The Average size of nano particles present in CnO Nano fluid in Water was found to be 18 nm.
2) The variation of electrical conductivity was observed to be almost Linear.
3) The effect of Copper Oxide Nano fluids on velocity of ultrasonic sound is negligible.

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