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Synthesis, Ultrasonic Characterization and Comparative Studies of Silver and Gold Nanofluids at Various Temperature

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Abstract - *Gold and Silver Nanofluids have been synthesized by One-step novel method using chloroauric acid and silver nitrate that have many interesting properties and the distinctive feature offers unprecedented potential for many applications. 0.1M chloroauric acid and silver nitrate is reduced by Ethylene glycol in the presence of sodium lauxyl sulphate. At various temperature, the value of frequencies maintained at 12MHZ and 10MHZ than the value of ultrasonic velocities are computed. The ultrasonic velocity, compressibility, acoustic impedance, intermolecular free path length, bulk modulus, rao's constant and surface tension were calculated by nanofluid interferometer model NF-12X. . The density of the Nanofluids which is prepared is calculated by using the specific gravity bottle. Additionally the fluids were analysis by UV, FTIR, XRD, and SEM. These techniques confirm that the synthesized particles are gold and silver nanofluids. The electrical conductivity of synthesized nanofluids was measured by digital electrical conductivity meter model. The end result data's equated with the idealistic date rates the graph has been plotted for various temperatures.*

Keywords: **Gold and silver nanofluid[1], ultrasonic parameters[2], XRD[3], SEM4, Electrical conductivity[5].**

1. INTRODUCTION

The most recent sophisticated seekings in nano technology have arised with the help o new emerging nano heat transfer fluids which are the get of innovations of this century irrespective of any field of research. This nanofluids has been prepared by sprinkling and suspending nano materials in traditional heat transfer fluids with the help o present technology. The studies shown suspending nano particle have likely to heighten the thermo physical, transport and radioactivity of the traditional fluid which in this case is also called as the base fluid. Since the property of fluid is enhanced, the fluid posses the ability to transfer more heat than the past which is the basic requirement of the current globalised world. Which have great trust in the production by machines? But to increase their efficiency by all means they completely depends on traditional heat transfer fluids which delayed the world from get going. This explains the revolution innovation of nanofluis which has the capacity to take our world for a big leap. Nanoparticle of materials. Such as nitride ceramics, carbide ceramics, metals metallic oxides, semiconductors, carbon nanotubes (single, double, multi walled), alloyed nanoparticles etc. has utilized in the process of preparation of these revolutionized nanofluids. This explains the current efforts to further increase the efficiency of thermal conductivity nature of coolants suspending solid is a century old choice, which was pioneered by Maxwell. Maxwell demonstrated the theoretical part by inverting the formula calculate the effective thermal conductivity of suspended particles in liquid medium. This becomes the origin to the begin for not alone theoretical but also for experimental studies the most remarkable ones were Hamilton-crosser and waps[3]. No or very little agglomeration of dispersed particle holds the hey to reach the stable nano fluid which has the tendency to show the genuine nano behavior. This can be achieved by using different techniques which included physical, chemical or even electrical. The wide spread technique which is a wail now to using ultrasonic [4]. In few rare occasions, the dispersion uses some stabilizing agents also depict all the best way to produce nanofluids is in the process of single step method [5]. This method have the flexibility of producing nanofluid itself instead of any intermediates or producing nanofluids so by using this method [5,6]. One can reduce the probability of agglomeration it all formulated a single step direct evaporation method [7]. To prepare Gold, Silver and Platinum nanoparticles Feng et al [8] developed aqueous organic phase transfer method. To synthesize copper nanofluids wei[9] et al continuous flow micro fluidic micro reactors. Measuring the thermal diffusivity of gold nanoparticle which is spherical in shape and also in different size and is formulated by Gerardo et al [10]. Ultrasonic nondestructive technique to characterize the

materials has certain important parameters such as the quantity of medium, ultrasonic velocity and includes attenuation also. In this the ultrasonic velocity has district relation to the elastic constructs and also depends on the density of the material which is used in the process.

2. EXPERIMENTAL PROCEDURE:

In the double distilled water the aqueous solution was prepared. Chloroauric acid $HAuCL_4$ (0.1M) and silver nitrate$AgNO_3$ (0.1M) has been mixed up with ethylene glycol solution of 25ml, sodium lauxyl sulphate of 50ml, sodium hypophosphate of50ml are along with this distilled water of 100ml is also included to synthesis Gold and Silver Nanoluids. At room temperature this entire mixture is stir up well for the time period of around half an hour. For Gold Nanofluid color over turned from green to violet and for Silver it is would be from blue to brown .
The chemical reaction involved is as follows,

$$NaH_2PO_2 + 3H_2O + AgNO_3 \dashrightarrow NaH_2PO_3 + HNO_3 + H_2 + Ag$$

$$NaH_2PO_2 + 3H_2O + HAuCl_4 \dashrightarrow NaH_2PO_3 + HCL_4 + H_2 + Au$$

3. RESULTS AND DISCUSSION

3.1. Ultrasonic velocity (ν)

In characterize the thermodynamic and physio-chemical facet of treble aqueous mixture ultrasonic study of aqueous mixture has gained huge importance in the present times.

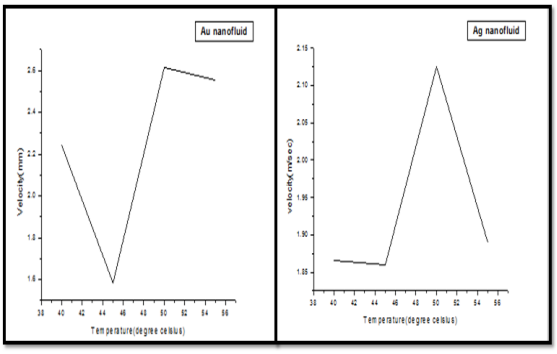

Fig-1: Temperature dependent sound velocity at Au &Ag nanofluids

3.2. Ultrasonic compressibility (β)

The study of sound propagation both in zthe hydrodynamic treatment and relaxation process yields that in the limit of low frequencies; sound velocity in a fluid medium

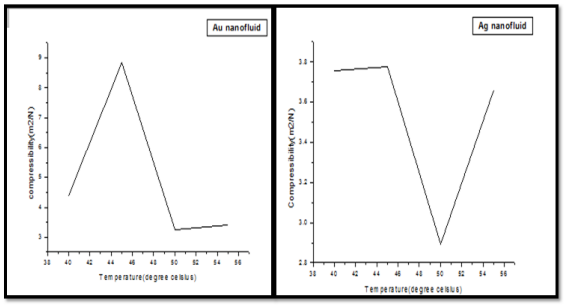

Fig-2: Temperature dependent sound compressibility at Au &Ag nanofluids

3.3. Acoustic impedance (Z)

Acoustic impedance since the molecules of atoms of a solid state have the tendency to bound electrically to one another, the pressure which is excess in this is the prime reason for wave propagation through the solid medium.

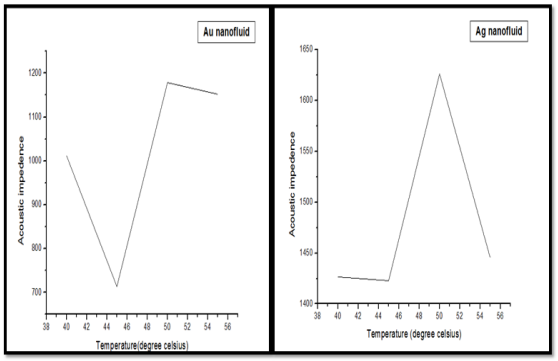

Fig-3: Temperature dependent Acoustic impedance at Au &Ag nanofluids.

3.4. Intermolecular free path length (L.F)

To measure the intermolecular attractions between the components in the binary mixture. The intermolecular free path length is the distance covered by sound wave between the surfaces of the neighboring molecules. It is measure of intermolecular attractions between the components in binary mixture.

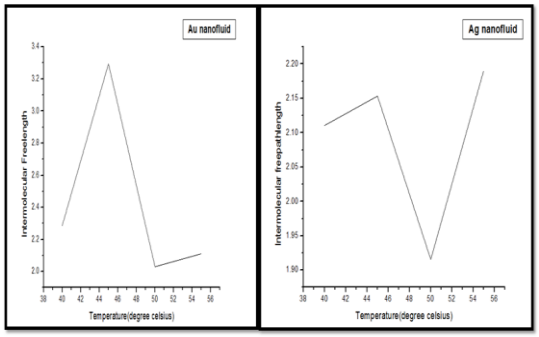

Fig-4:Temperature dependent Intermolecular free path length at Au &Ag nanofluids

3.5. Bulk modulus (k)

The relative change in the volume of a body produced by a unit compressive or tensile stresss acting uniformly over its surface.

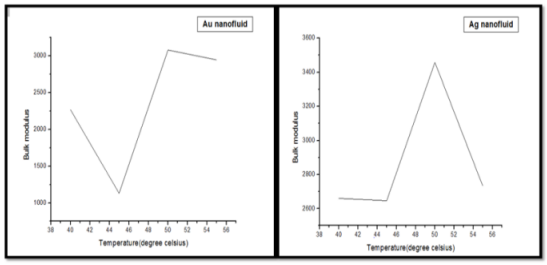

Fig-5: Temperature dependent Bulk modulus at Au &Ag nanofluids

3.6. Rao's constant (R)

Rao's constant is an additive property it also known as molar sound velocity. It has been found to be invariant with pressure and temperature for inorganic and organic liquid.

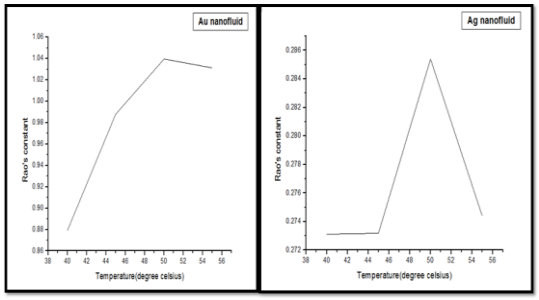

Fig-6: Temperature dependent Rao's constant at Au &Ag nanofluids

3.7. Result of XRD and UV analysis

The phase structure and the purity of the products were examined by X-ray diffraction studies. The XRD pattern of as obtained gold and silver nanofluid is shown in fig7 and fig 8. The XRD analysis of the nanofluids has confirmed. The metallic gold and metallic silver is formed in the solution. Fig 9 and fig 10 are the UV-Vis spectrum of gold and silver nanofluid. The absorption edge at 534 nm and 414 nm indicates the peak due to gold and silver nanofluids. The peak typically represent the formation of small metal nanoparticles in the solutions.

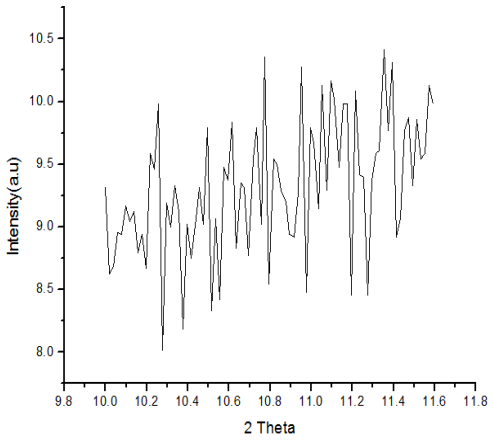

Fig-7:A typical XRD pattern of gold nanofluid

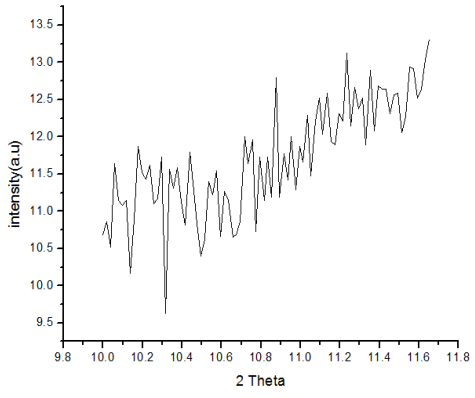

Fig-8: A typical XRD pattern of silver nanofluid

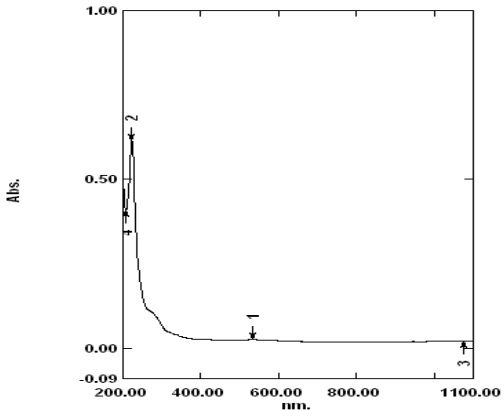

Fig-9: A typical UV-Vis spectrum of gold nanofluid

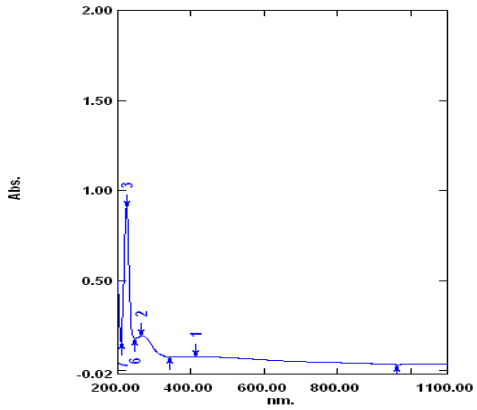

Fig-10: A typical UV-Vis spectrum of silver nanofluid

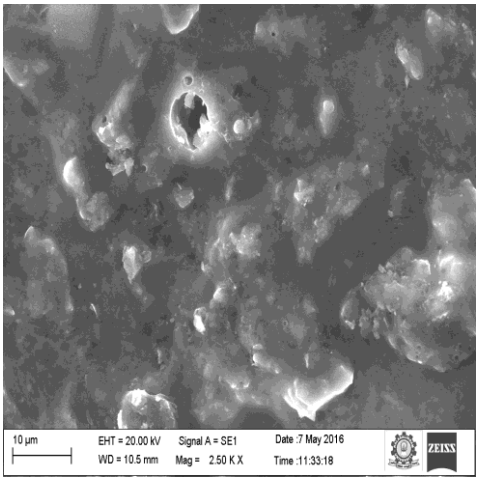

Fig-11: A typical SEM pattern of gold nanofluid

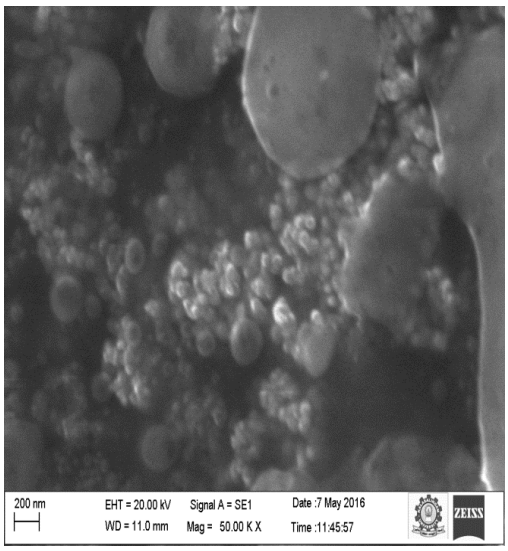

Fig-12: A typical XRD pattern of Silver nanofluid

3.8. Result of density (ρ), surface tension(T) and Electrical conductivity:

Sample fluids	Density Kg/m³	Surface tension	Electrical conductivity (gm)
Gold nanofluid	450.4	0.5656	0.197
Silver nanofluid	764.9	1.2224	0.108

4.Conclusions:

We have successfully synthesized gold and silver nanofluids by a novel one-step method. The nanofluid has been reported using chloroauric acid and silver nitrate. A base fluids of ethylene glycol and water were carried out of the reduction using sodium lauxyl sulphate(SLS). Synthesized fluids were characterized by various techniques. Ultrasonic nanofluid interferometer parameters show interesting behavior. This method proves to be simple rapid, cost effective and highly useful of the synthesized fluids.

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