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Fabrication of MWCNT-Ferrite Nanocomposite For Designing Low Cost Computer

Amrut Ranjan Jena[1], *Madhusmita Mishra*[2]
[1]*Asst.Prof, Dept. Of CSE, C.V.Raman College of Engineering, Bhubaneswar, Odisha*
[2] *Asst.Prof, Dept. Of CSE, C.V.Raman College of Engineering, Bhubaneswar, Odisha*

Absract

Nanotechnology is one of the fast developing branches of hybrid science combining physics, chemistry and engineering. One of the major implications of this technology will have on the future field of engineering. This paper work intends the role of nanotechnology in increasing the efficiency of the computer that is the future computer chips will contain more circuitry and components within it.

Key words-Nanotechnology,Ferrite, MWCNT, nanocomposite, magnesium ferrite, Quantum factor, Total Inductance.

1.Introduction

Nanotechnology is one of the fast developing branches of hybrid science combining physics, chemistry and engineering. One of the major implications of this technology will have on the future field of engineering. This research work intends the role of nanotechnology in increasing the efficiency of the computer that is the future computer chips will contain more circuitry and components within it.
Nanotechnology' refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products.

Nanotechnology can best be defined as a description of activities at the level of atoms and molecules that have applications in the real world. A nanometer (nm) is one billionth of a meter that is, about 1/80,000 of the diameter of a human hair, or 10 times the diameter of a hydrogen atom. The size-related challenge is the ability to measure, manipulate, and assemble matter with features on the scale of 1-100nm. In order to achieve cost-effectiveness in nanotechnology it will be necessary to automate molecular manufacturing. The engineering of molecular products needs to be carried out by computing devices, which have been termed nanocomputers.

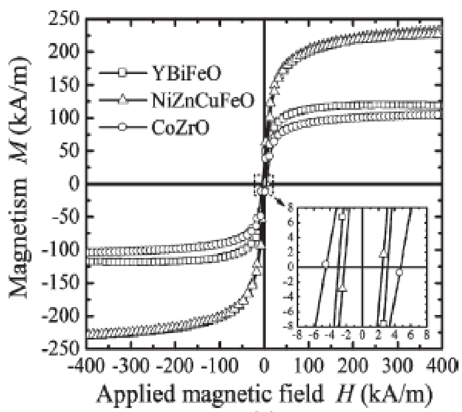
2.Multi walled Carbon Nanotube(MWCNT)-Ferrite

Multi-walled carbon nanotubes (MWCNTs) have attracted considerable attention in the fields of synthesis, and technological applications due to their fascinating one-dimensional tubular structures, electronic, mechanic and chemical properties. Modification of MWCNT with metals, metal oxides, complex metal oxides and polymers can be improved physical and chemical properties of MWCNTs. The magnetic modification of MWCNTs makes them possess unique magnetic nature. Magnetic MWCNTs have potential applications as magnetic data storage , microwave absorbing materials , magnetic composites.

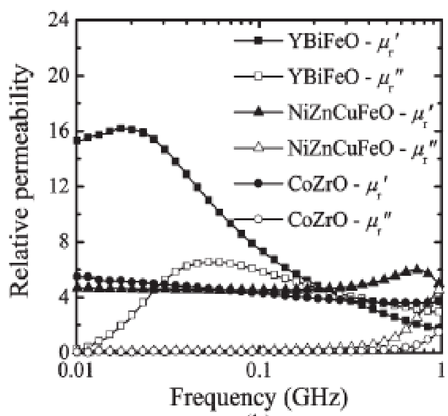
The spinel ferrite of nanoparticles and composition MFe_2O_4 (M = Co, Ni, Mn, Mg, Fe or Zn) exhibit interesting magnetic, magetoresisitive, and magnetooptical properties that are potentially useful for a broad range of applications. Among magnetic ferrites, Magnesium ferrite ($MgFe2O_4$) has attracted significant research interest based on its fascinating magnetic and electromagnetic properties. It has a cubic structure of normal spinel-type and is a soft magnetic n-type semiconducting material, which finds a number of applications in heterogeneous catalysis, adsorption, sensors, and in magnetic technologies. So far reported nanostructures of $MgFe_2O_4$ are mostly in the form of nanoparticle .

The devices that utilize the properties of low dimensional objects such as nanoparticles are promising due to the possibility of tailoring a number of electrophysical, optical and magnetic properties changing the size of nanoparticles, which can be controlled during the synthesis. In the case of polymer nanocomposites we can utilize the properties of disordered systems. Though there is much utilization in this field, there are many limitations also. For example in the release of drugs using nanofibres, cannot be controlled independently and a burst release is usually the case, whereas a more linear release is required. Let us now consider future aspects in this field. There is a possibility of building ordered arrays of nanoparticles in the polymer matrix. A number of possibilities also exist to manufacture the nanocomposite circuit boards. An even more attractive method exists to utilize polymer nanocomposites for neural networks applications. Another promising area of development is optoelectronics and optical computing. The single domain nature and super paramagnetic behavior of nanoparticles containing ferromagnetic metals could be possibly utilized for magneto-optical storage media manufacturing.

In the given graph the properties of the ferrite material has been studied.



(a)



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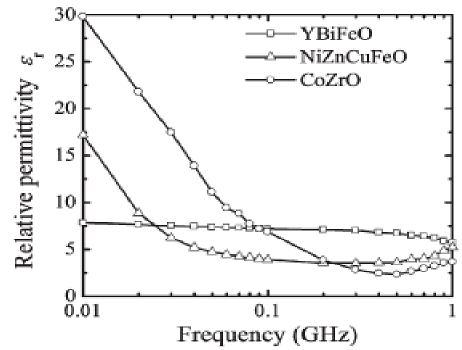
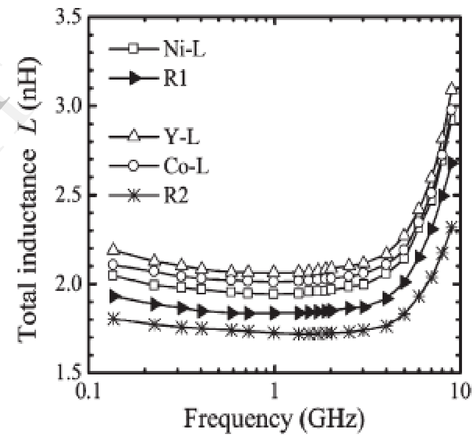
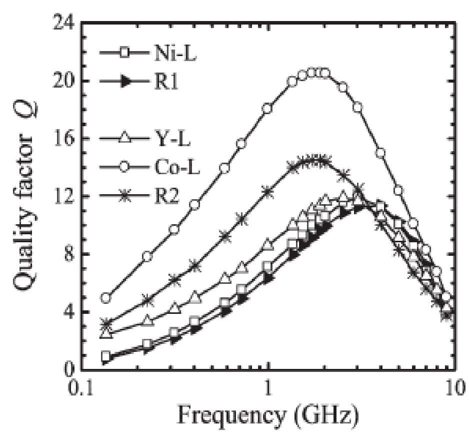


(c)

Figure 1: Measured ferrite thin-film properties- [a] M-H characteristics [b] High-frequency permeability (Quantum factor) [c] High-frequency permeability



(a)



(b)

Figure 2: Measuring comparison for ferrite integrated material with air-cored material-[a] Total Inductance L [b] Quality Factor Q

3.Methodology

(A)Modification of MWCNT

For the better attachment with the polymers the modified MWCNT is more preferred than the unmodified MWCNT. The MWCNT will suspend in a 3:1 mixture of concentrated H_2SO_4 and HNO_3 and refluxe for 30 minutes in an ultrasonic bath. The solution will be magnetically stirred and heated at 60^0C for 24 hours. This treatment provides carboxylic acid groups at defects in the surface of tubes and exfoliates graphite. The obtained c-MWNTs will filter through 0.2 µm polytetrafluorethylene (PTFE) membrance filter and will wash with plenty of deioxized water until the pH value will around 7 and then has to dry at 70^0C for 24 hours.

(B) Preparation of the MWCNT – Ferrite Nanocomposites

MWCNTs will mille and disperse in a 3/1 mixture of H2SO4/ HNO3 by an ultrasonic shaker. The mixture wills refluxe for 17 h at 120 °C. Then it will cool, filter and wash by distilled water adjusted at pH 6. Finally, the oxidized carbon nanotubes (MWCNTs) will dry at 100 °C for 12 h before use. An insitu chemical citrate-gel method will develop to obtain the $MgFe_2O_4$ - MWCNTs precursor. A proper amount of MWCNTs will first add to a solution of citric acid ($C_6H_8O_7.H_2O$) and ultrasonicate in distilled water for 10 min. Afterward, this suspension will mix with an aqueous solution of $Mg(NO_3)_2.6H_2O$ and $Fe(NO_3)_3.9H_2O$, in which the Mg:Fe molar ratio will maintained at 1:2. In order to reach the PH of the solution to 9, ammonia solution will drop wisely add to the mixture with vigorous stirring. The mixture will also stirre at 30 °C for 48 h and dry in an oven at 100°C for 12 h, followed by calcination at temperature 475°C and 600 °C for 2h in an Argon atmosphere. Also we will synthesize magnesium ferrite ($MgFe_2O_4$) nanoparticles by citrate-gel method. To synthesize nanoparticle, $Fe(NO_3)_3$ and $Mg(NO_3)_2$ mixed solution will add to citric acid dissolve in distilled water. The solution will stirre and then will concentrate until a viscous liquid will obtain. The liquid will dry in an oven at 120 °C and calcine at temperature 600 °C for 2h in an Argon atmosphere.
Using these MWCNT-Ferrite nanocomposites computer chips will be fabricated by the method developed by us to be used for the manufacture of the nanocomputer.

4.Conclusion

Now a days the development of nanotechnology progresses in several disciplines including physics, chemistry, biology, material science and different engineering fields like mechanical nanocomputing ,electronics nanocomputing ,bio-chemical nanocomputing and quantum computing, computer scientists must be aware of their roles and brace themselves for the greater advancement of nanotechnology in the future. In this proposed paper work our interest is to design a computer chip with the help of MWCNT-Ferrite -nanocomposite for developing low cost computer.

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