ENCLOSURE-I

OBJECTIVES OF THE PROJECT

TITLE OF THE PROJECT:

STRUCTURAL & ELECTRICAL PROPERTIES OF Sb^{5+}, Nb^{5+} SUBSTITUTED NANO NICKEL-ZINC FERRITES

DURATION: 1 Year

TOTAL COST OF THE PROJECT: 1.5 lakhs

OBJECTIVE OF THE PROJECT:

Nanoferrites have high electrical resistivity and consequently low eddy currents and dielectric losses. They have wide range of applications in electronics, computers and medicine.

The problem to be investigated in the proposed research work is structural and electrical properties of Nickel-Zinc ferrites by substituting these with high valency cations like Niobium (Nb) and Antimony (Sb). This includes a detailed study of synthesis and investigation of their properties.

The testing will be done at Indian Institute of Chemical Technology, Hyderabad.

ENCLOSURE-II

LIKELY BENEFITS OF THE PROJECT

Technology in the twenty first century demands devices of small size and enhanced performance. Nanomaterials are the materials of grain sizes below 100nm which fulfill the requirements of the industry. The synthesis of nanostructured materials is attracting a great deal of attention because of their potential applications in areas such as electronics, optics, catalysis, and magnetic data storage. The unique properties and the improved performance of nanomaterials are determined by their size, surface structure and inter particle interaction. The particle size plays an important role in determining the properties of the material.

Magnetic particles with sizes in the nanometer scale are now of interest because of their many technological applications and unique magnetic properties which differ from those of bulk materials. Magnetic nanoparticle systems exhibit super paramagnetic behaviour, display little or no remanence and coercivity while keeping a very high saturation magnetization.

Nickel-Zinc ferrites are the high frequency ferrites usable in the frequency range 1-2 MHz to 5-600 MHz depending on material composition. Due to this reason, they have wide range of applications in

(i) Telecommunication.
(ii) EMC/EMI suspension.
(iii) Broad-band Transformers.
(iv) Impedance Matching
(v) Antennas

These ferrites have wide range of applications in

(i) Microwave applications
(ii) Pulsed applications in accelerators
(iii) Biomedicine
(iv) Magnetic drug delivery and cell-storing systems
(v) Magnetic refrigeration technology
(vi) sensors

The present area of research on nickel-zinc ferrites can replace the devices used now in telecommunications, biomedical, electronics industries which will be a great use to the Puducherry University.

ENCLOSURE-III

METHODOLOGY OF THE PROJECT

The first step is to synthesize nanoparticles of the nickel ferrites by hydrothermal method.

Then the size and crystal structure of the formed particles will be determined using x-ray diffraction method.

A comparative study of the change in interplanar spacing 'd' with particle size can be made at different annealing temperatures. This leads to understand whether lattice contracts or expands. This helps us to understand the nature of ions and electrostatic forces existing between them. Further the shape of grains and the contact with one atom can be obtained using SEM. The morphology of the samples can be obtained.

Then FTIR studies will be performed. Due to small size of grains and the large surface to volume ratio of the nano crystals, the FTIR frequencies differ greatly from that of bulk crystals. The evolution of new bands and shift in IR active mode due to surface amorphousness, fulfill the objective of studying symmetric, stretching, antisymmetric stretching; symmetric bending and antisymmetric bending between metal ions and oxygen ions.

The next objective would be to study phase changes with temperature in the proposed nanoferrites. The temperatures at which different reactions would take place and departing of different occluded components would be studies using TG and DTA methods.

The final objective would be to study and compare with bulk crystals, the electrical properties like dielectric constant, dielectric loss and ac conductivity of nano ferrites in the frequency range 10KHZ to 13KHZ. Hopping mechanisms involved in ac conductivity would be explored. The observed variation of electrical properties with frequency would hopefully throw light on the prominent interaction between adjacent Zn^{2+} ions on the interaction. The magnitude of the dielectric parameters and their variations in microwave range frequencies show the essential properties required for making various microwave devices.