DR14

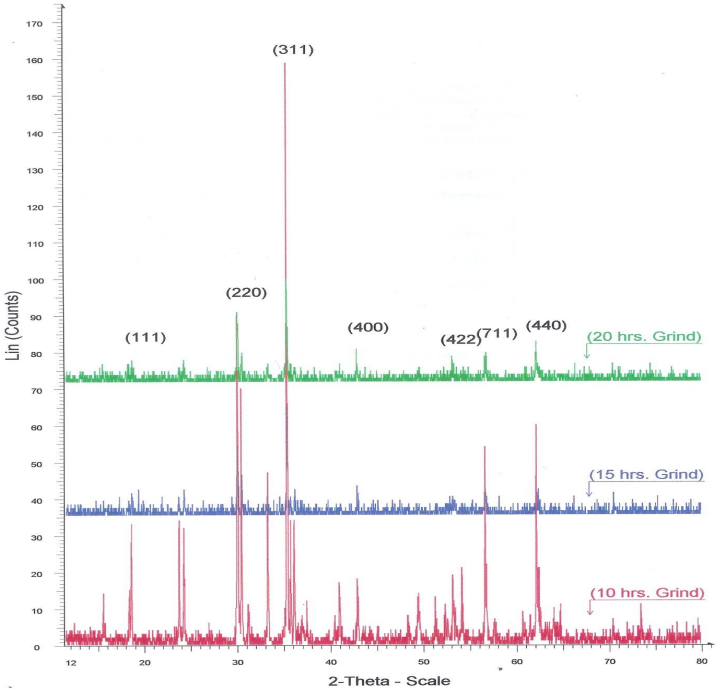
Investigations on Mn-Zn Ferrite Nanaoparticles

Nitu Kumar*, Vinod Kumar, and R P Pant

National Physical Laboratory, Dr. K.S. Krishnan Marg New Delhi, India-110012

*Corresponding Author: Nitu Kumar, email: chauhannitu@gmail.com

Nano-particles of $Mn_{1-x}Zn_xFe_2O_4$ (0.2<x<0.8) have been synthesized by grinding MnO, ZnO and Fe_2O_3 oxides using high energy ball mill (HEBM) and varying the milling period between 0~20 hrs at 350 rpm. The grounded powder was analyzed for analyzing the crystalline phase formation by X-ray diffraction technique after every 5 hrs. X-ray diffraction pattern confirm the phase formation of Mn-Zn ferrite after 5 hrs of grinding. X-ray diffraction patterns also show the improvement of crystallinity and increase of the particle size with the increase in the grinding period (Figure). It was observed that the crystallite size increases with increasing Mn concentration which has been attributed to the higher atomic radius of Zn atoms as compared to the Mn atoms. Infrared spectra of different concentration of Zn doped Mn-ferrite nanocrystalline powder are dominated by the vibration peaks in the range of 200~700 cm^{-1} pertaining to different zinc concentration. The change in the intensity of absorption band might be due to the difference in concentration of zinc ions at tetrahedral sites. In these spectra symmetric stretching mode of tetrahedral Fe_3O_4 group is obtained at 651 cm^{-1} in a compound having 0.6 % Zn and this band shifted to 669.7 cm^{-1} in 0.8 % Zn doped samples. IR data reveals the confirmations of the metal oxide bonding of the ferrite, which varies with the increase of milling time. Similarly, scanning electron microscope (SEM) was used to study the effects of grinding on particle size. These materials have been utilized in making the humidity sensor in the nano size range because of high sensitivity and porosity.



DS01

Electromagnetic Characteristics and Microwave Magnetism of $Fe_{46}Co_{44}B_{10}/SiO_2$ Nano-multilayers

Deng Lianwen*, Chen Hongfei, Zhou Kesheng, and Yang Bingchu

School of Physics Science and Technology, Central South University, Changsha 410083, China

*Corresponding author: Deng Lianwen, e-mail: dlw626@163.com

$Fe_{46}Co_{44}B_{10}/SiO_2$ nano-multilayers were synthesized by radio frequency magnetron sputtering. Morphology was analysed by transmission electromicroscope. Thickness of individual layer of multilayers was designed and controled in nano-meter and effect of thickness of ferromagnetic layer, insulative layer or the total number of layers on the intrinsic characteristics and microwave permeability were evaluated respectively. Results show that, Saturation magnetization changes obviously with different thickness of ferromagnetic layer or insulative layer, but coercivity changes little and remains small value of a few Oe. When thickness of ferromagnetic layer and insulative layer keeps 1.5 nm and 1.3 nm respectively and the total number of layer increase from 10 to 90, coercivity reduces and resistivity of the films improve from 2.5 to 22.2 mΩ·cm. If thickness of ferromagnetic layer, insulative layer and the total number of layers are optimized, the resonant frequency will locate at the point higher than 2 GHz and permeability at 2 GHz is larger than 150. These multilayer films can be applied in the field of micromagnetic devices or anti-interference of electromagnetic wave.

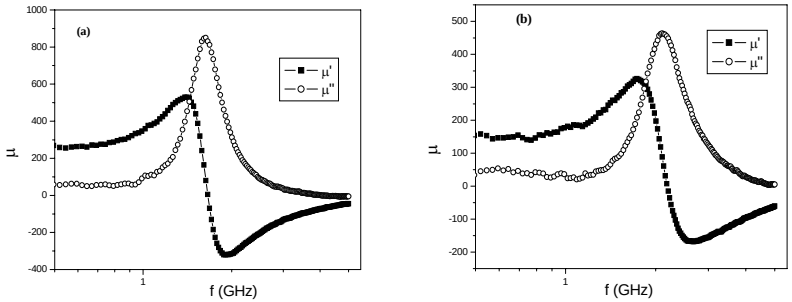


Fig. 1. Permeability spectra of $Fe_{46}Co_{44}B_{10}/SiO_2$ nano-multilayers with different total number of layers : (a) 30, (b) 60.

This work is supported by the National Natural Science Foundation of China under contract number 60771028.

REFERENCES

[1] G. Pan *et al.*, J. Appl. Phys. 93, 5498 (2003).
[2] K. McNeill *et al.*, J. Appl. Phys. 87, 5837 (2000).