International Journal of Scientific Research in Physics and Applied Sciences
Research Paper Vol-2, Issue-1 E-ISSN: 2348 – 3423

XRD and X –ray, K-Absorption Near Edge Studies of Cobalt, Nickel Ferrites

P K Malviya[1*], P Sharma[2] and A. Mishra[1]

[1]*School of Physics, DAVV, Indore (M.P)- India*
[2*]*Department of Physics, Govt. Holkar Science College, Indore (M.P)- India*

Available online at www.isroset.org

Received: 8 Nov 2013 Revised: 18 Nov 2013 Accepted: 12 Oct 2013 Published: 28 Feb 2014

Abstract-The Co-Ni ferrites with general formula $Co_{1-x}Ni_x Fe_2O_4$ (where x=0.0, 0.05, 0.10) were prepared by solid state root method. The X-ray diffraction and X-ray, K- absorption near edge measurement were carried out. XRD shows the structure of sample is the cubic with the help of PCPDF win/ JCPDS-ICDD 1997.

Key Words- Ferrite, XRD, XANES

I. INTRODUCTION

Co –Ni ferrites are mixed ferrites and the co-ordination of the Fe+3 ion in the system is very little affected by the changes in compositional parameters [1].It is reported that the vacancy concentration of Oxygen is important parameter in the sintering process of spinel ferrites. It is also reported that electrical resistance of Co ferrites decreases whit increasing quenching temperature, which is mainly attributed to the decrease of grain boundary resistance in Fe-excess Co- ferrites [2, 3].

X-ray diffraction-XRD is one of the most prominent techniques used for addressing all the uses related to crystal structure , lattice parameter, particle size, and orientation of polycrystals. If the wavelength emitted in the form of photon has a value 10-6 -10-10cm, then they are referred to as X-rays [4]. The X-ray absorption near edge structure is the part of the absorption spectrum near absorption edge, ranging from approximately 0 eV to 50 eV relative to the edge energy [6]

II. EXPERIMENTAL

The low cost parent oxides (Fe_2o_3, CoO, NiO) were used are raw materials. The ferrites of different composition $[Fe_2Co_{(1-x)}Ni_{(x)}O_4, x=0.00,0.05,0.10]$ were prepared using conventional solid state method. Powder was thoroughly mild and mixed by hand grinding tool.The sample heated for 8 hours in 900 ^{0}Cby furnace.

The XRD measurements were carried out using Bruker D8 Advance X-ray diffract meter (IUC, DAVV, Indore) . The X-ray were produced using a sealed tube and the wavelength of X-ray was 0.154nm (Cu K-alpha). The X-ray was detected using a fast counting detector based on silicon strip technology.

The X-ray absorption spectra have been recorded using synchrotron radiation .The X-ray spectroscopy setup is available at Raja Ramanna Centre for Advanced Technology (RRCAT) Indore, India and is called beam line .This beam line BL-8 has been recently commissioned at the 2.5 GeV Indus-2 synchrotron radiation sources.

*Corresponding Author: *P K Malviya,*

III. RESULTS AND DISCUSSION

The sample was characterized at room temperature by X-ray diffraction using Cu Kα radiation. X-ray diffraction studies of the Ferrites are-Fe_2O_4Co, $Fe_2O_4Co_{(.05)}$ $Ni_{(.05)}$, $Fe_2O_4Co_{(.09)}$ $Ni_{(.10)}$ are indicative of their cubic nature. The diffraction pattern of complexes recorded between 2θ ranging from 10° to 80°. The crystalline size of the samples is estimated using the Scherrer's formula. According to Scherrer's equation [5], the grain size is given by $t = 0.9 \lambda / B \cos\theta$, where t is the crystal thickness , B is half width of the diffraction line, θ is the Bragg angle and λ is the wavelength. The grain size corresponding to each diffraction maxima can be determined from the measurement of the half width of the diffraction peak. The diffraction patterns have been successfully indexed. Lattice parameter for simple cubic crystal structure is determined by $a^2=\lambda^2(h^2+k^2+l^2)/4\sin\theta$. The value of the crystalline size is shown in Table 01. The crystalline size was found to be within in the range 4.8 to 5.22 nm. The XRD peaks of a single phase were indexed and particle size was calculated for the ferrites. X-ray powdered diffraction studies of the five ferrites were recorded, the prominent lines were indexed. The XRD patterns of the studied samples are shown in Figure (1) and XRD calculation show in table 1.

TABLE 1. Particle Size and lattice parameter

Particle size (nm)	Lattice Parameter(Å)
4.80	8.52
5.34	8.43
5.52	8.35

IV. CHEMICAL SHIFT

Present chemical shift values are (8.22 eV to 8.60 eV), therefore suggestive of covalent character of all sample

© 2014, IJSRPAS All Rights Reserved

Shown in table 2 and near edge fine structure show in figure 2(a), 2(b), and 2(c).

$Fe_2O_4Co > Fe_2O_4Co_{(.05)}Ni_{(.05)} > Fe_2O_4Co_{(.09)}Ni_{(.10)}$

V. Conclusion

XRD shows that all samples are cubic and Ni concentration is increase then increase particle size and decreases lattice parameter.

XANES also shows that Ni concentration is increase then increase chemical shift and decrease edge width of Fe K-edge.

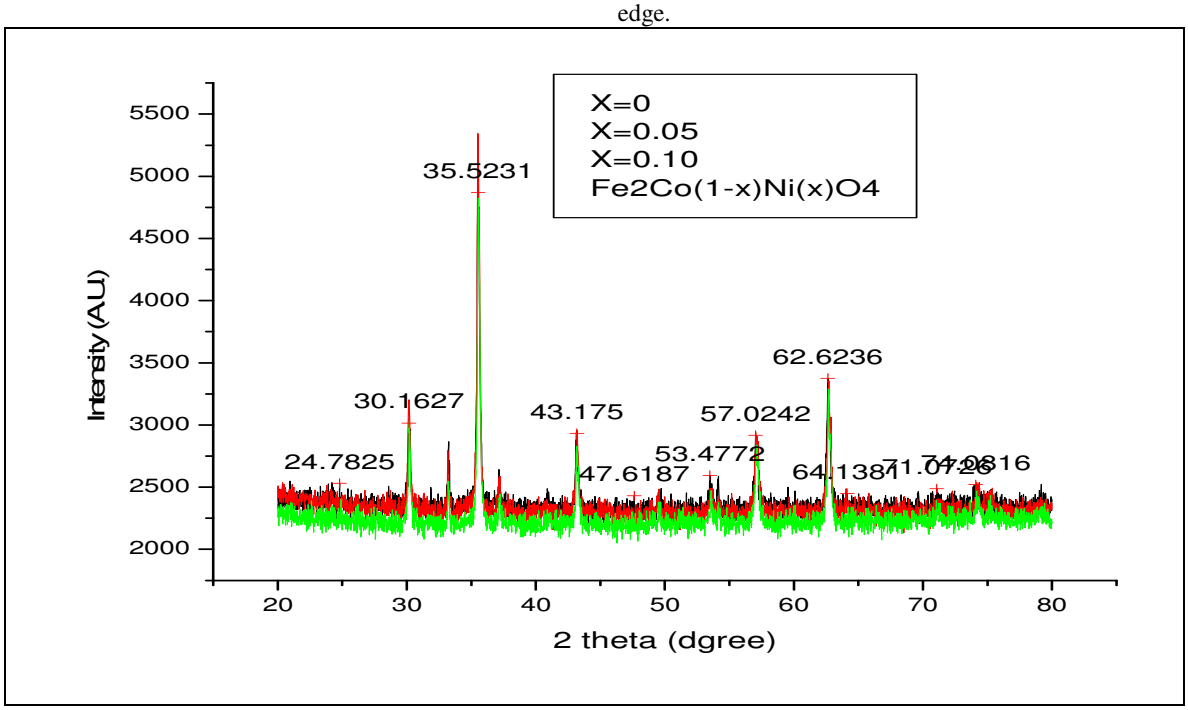

Fig-1 XRD Patten

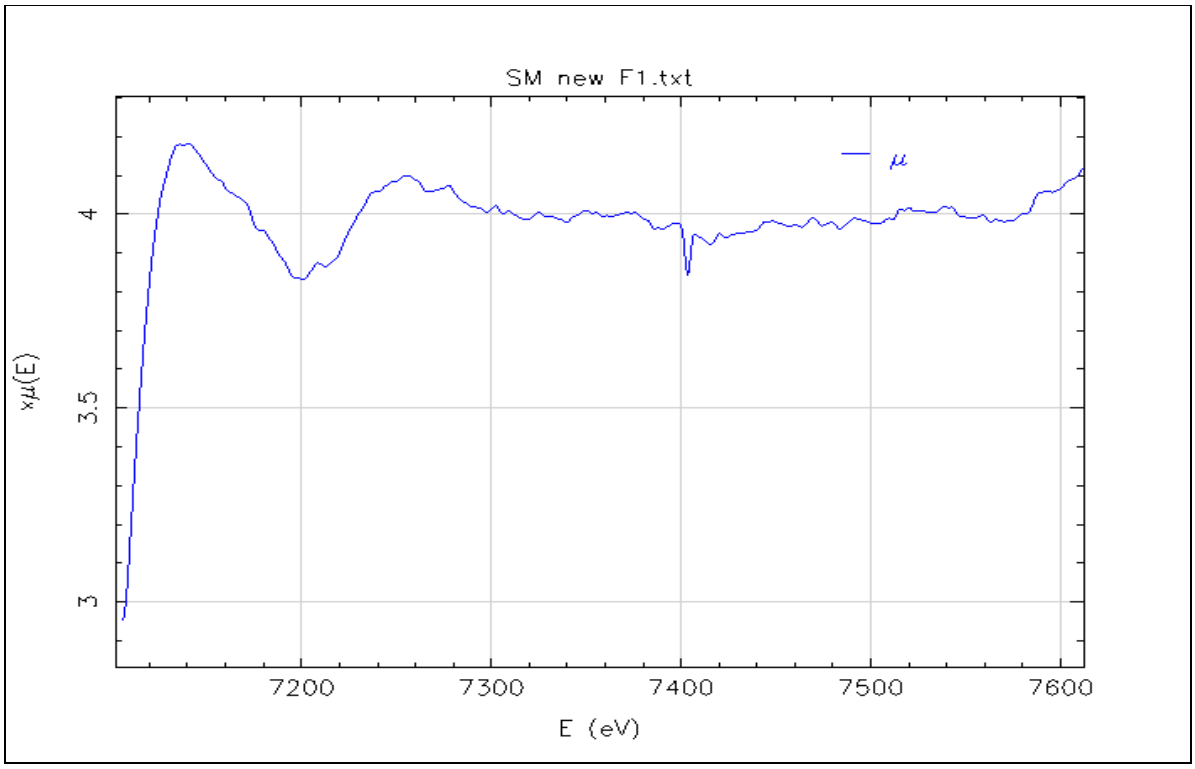

Fig. 2(a) XANES structure in of Co –Ni Ferrites

© 2014, IJSRPAS All Rights Reserved

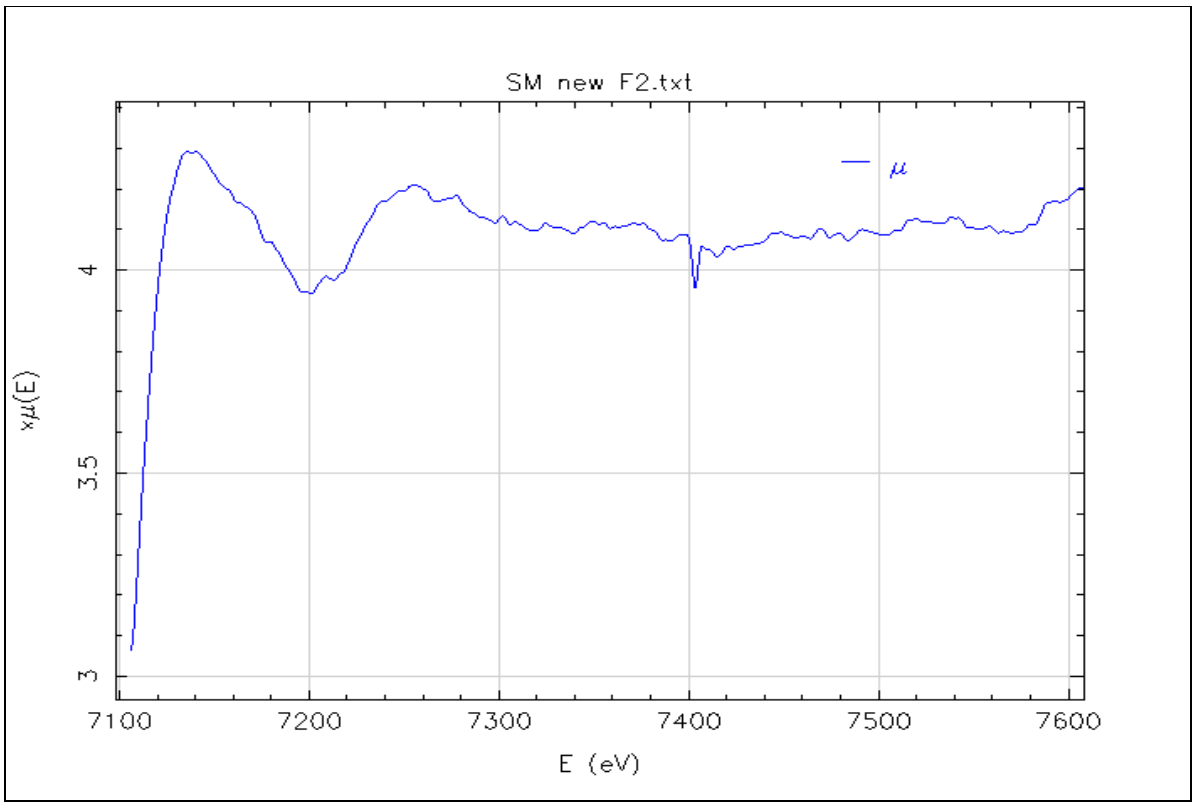

Fig 2(b) XANES structure in of Co –Ni Ferrites

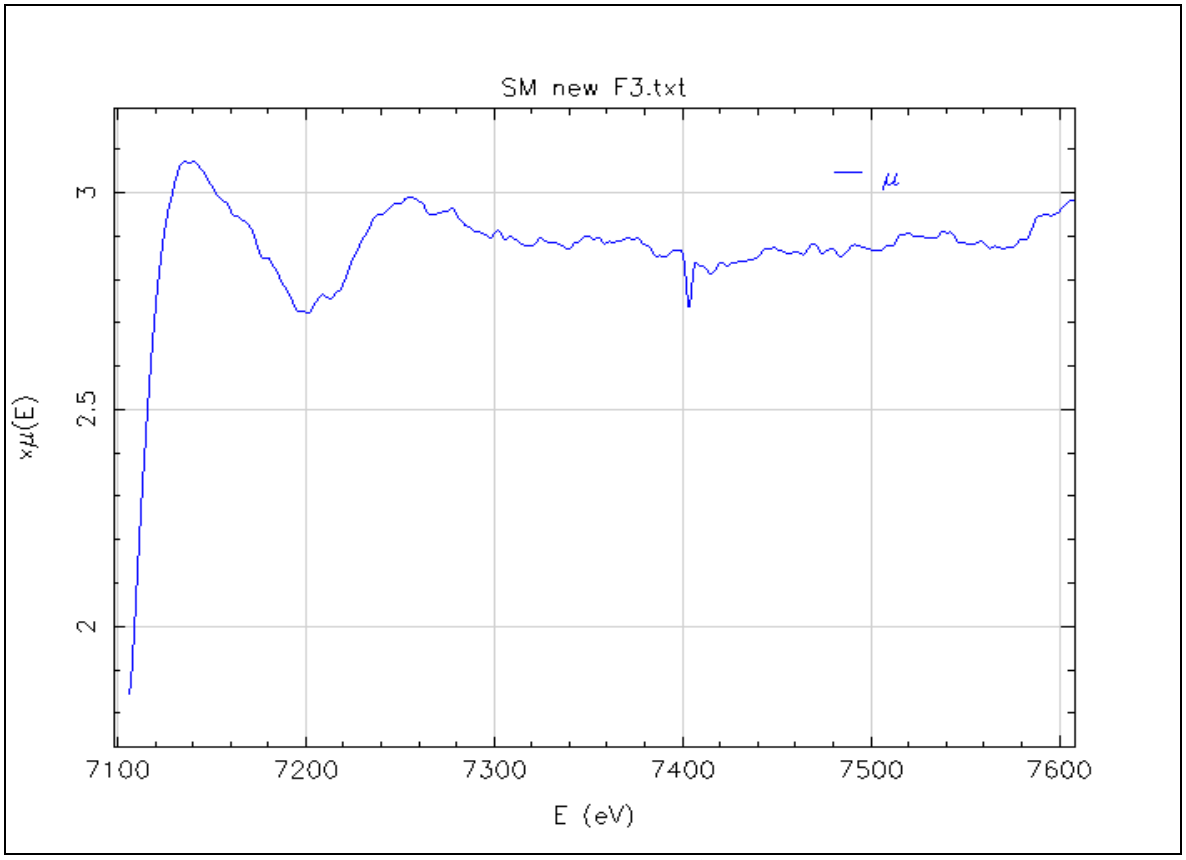

Figure 2(c) XANES structure in of Co –Ni Ferrites

© 2014, IJSRPAS All Rights Reserved

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my supervisor Dr. S N Jha, RRCAT, Indore, India for his continuous support, criticism, encouragement and invaluable assistance throughout the course of this study. His criticism has always challenged and brought the best out of me. His enthusiasm towards the work, knowledge and friendly nature has inspired and shaped me in different ways.

REFERENCES

[1]. Malik-F.A; Zahid –M;Hassan ,M.A .Proceeding 4th international symposium on Advanced materials, (**1995**), pp **618-623**.
[2]. Rana-M.U; Islam-M.U; Ahmad-I ; Abbas I, proceeding 5th International symposium on Advanced materials ,(**1997**) pp- **283-287**.
[3]. T.Abbas ,M.U.Islam ,Modern physics Letters B ,(**1995**) Vol.**09**, No.**22**, pp- **1419-1426**.
[4]. Elements of X-ray diffraction, B. D. Cullity, **1956**, Addison-wesley publishing company,Inc..
[5]. P. Scherrer, Go¨ttinger Nachrichten. **2**, **98** (**1990**).
[6]. B.K.Agrawal and L.P. Verma ,j.Phys. C3, **535** (**1970**)
[7]. Teo, B.K. and Lee, P.A., J.Am.Chem. Soc. **101**, **2815** (**1979**).

TABLE 2 chemical shift of K-absorption edge of Co, Ni Ferrites-

Ferrites	**E_K-Edge(eV)**	**E_A(eV)**	**Chemical Shift (eV)**
Fe_2O_4Co	7120.20	7140.2	8.20
$Fe_2O_4Co_{(.05)}Ni_{(.05)}$	7120.27	7137.13	8.27
$Fe_2O_4Co_{(.09)}Ni_{(.10)}$	7120.6	7139.2	8.60

Energy of Fe absorption edge E_k present Experimental Values =7122.00 eV

© 2014, IJSRPAS All Rights Reserved