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STUDY OF MAGNETIC PROPERTIES OF $MgZn_xMn_xFe_{2-2x}O_4$ SPINEL FERRITE SYSTEMS

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Abstract: *The samples of $MgZn_xMn_xFe_{2-2x}O_4$ spinel ferrite systems with varying x [x = 0.0, 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6] were synthesized by double sintering ceramic method. A. R. grade oxides of magnesium, zinc, manganese and ferric were used for the preparation of $MgZn_xMn_xFe_{2-2x}O_4$ ferrite. All the synthesis powders were characterized by using X-ray diffraction (Philips X-ray diffractometer, Model PW3710) technique at room temperature. The X-ray diffraction patterns were recorded in the 2θ range of 20^0-80^0 using Cu-K_α radiation. The magnetic properties were measured using pulse field technique provided by Magneta company.*

INTRODUCTION

The spinel ferrite represented by the formula MFe_2O_4 (where, M = Ni, Cu, Mn, Co, Fe, etc.) have a value for many technological applications due to their insulating property, high permeability, and moderate magnetization. The spinel ferrites are used in high frequency transformers, filters, isolators, automobiles, communication equipments, radio, television, and microwave and satellite communication [1]. Magnesium ferrites have been the subject of study for a long time [2, 3]. A number of researchers have studied the electrical and magnetic properties of magnesium ferrite substituted by divalent [4], trivalent [5] and tetravalent [6] ions. The simultaneous substitutions of divalent non magnetic and tetravalent magnetic cations like Zn, Mn

ions in magnesium ferrites may give rise to an interesting result.

Experimental details:

The samples of $MgZn_xMn_xFe_{2-2x}O_4$ spinel ferrite systems with varying x [x = 0.0, 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6] were synthesized by double sintering ceramic method. A. R. grade oxides of magnesium, zinc, manganese and ferric were used for the preparation of $MgZn_xMn_xFe_{2-2x}O_4$ ferrite. [7]

The magnetic properties were measured using pulse field technique provided by Magneta company. A.C. susceptibility measurements were carried out using double coil setup in the temperature range 300-800K. [8]

Results and discussion:

The magnetic properties like saturation magnetization (M_s), remanant magnetization (M_r), coerecivity (H_c) and others are investigated using pulse field hysteresis loop technique. Fig 1 (a and b) represents the M-H plots for all the compositions(x=0.0 to0.6). All the samples of the series $MgZn_xMn_xFe_{2-2x}O_4$ exhibit typical hysteresis curve showing ferrimagnetic behavior of the samples. These M-H plots are used to obtain the values of coercivity, remanant magnetizations etc. and the values of these magnetic parameter are presented in Table 1.

The values of saturation magnetization are used to determine the magneton number (n_B)(the saturation magnetization per formula unit in μ_B). [9]

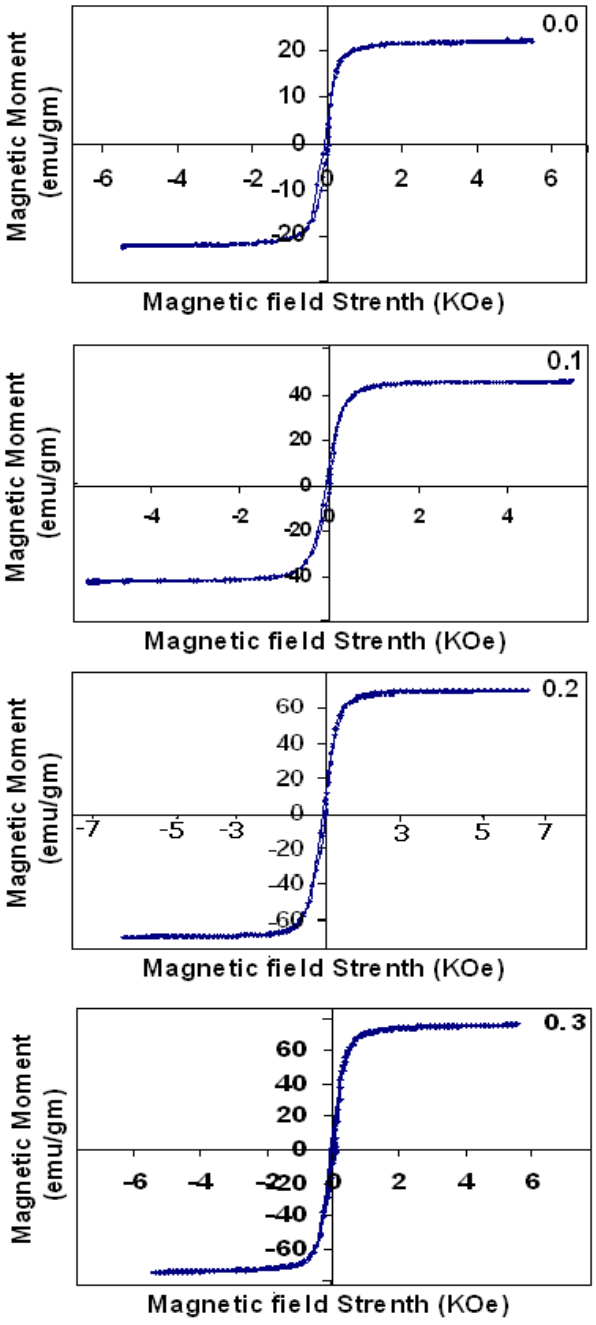
The decrease in Curie temperature with increase in zinc ion concentration 'x' is related to decrease in magnetic linkages associated with tetrahedral (A) and octahedral [B] site. [10]

Table 1

Magnetization parameters of the system $MgZn_xMn_xFe_{2-2x}O_4$.

Comp. x	Magnetization parameter		
	Mr (emu/gm)	Ms (emu/gm)	Hc (Oe)
0.0	4.24	22.50	58.48
0.1	1.62	45.93	2.34
0.2	0.19	70.01	11.18
0.3	27.31	76.12	42.83
0.4	0.75	75.29	6.93
0.5	12.76	52.90	33.23

Figure 1. a) Variation magnetic field strength with magnetic moments for the system **$MgZn_xMn_xFe2_{-2x}O_4$ for X = 0.0, 0.1, 0.2, 0.3**



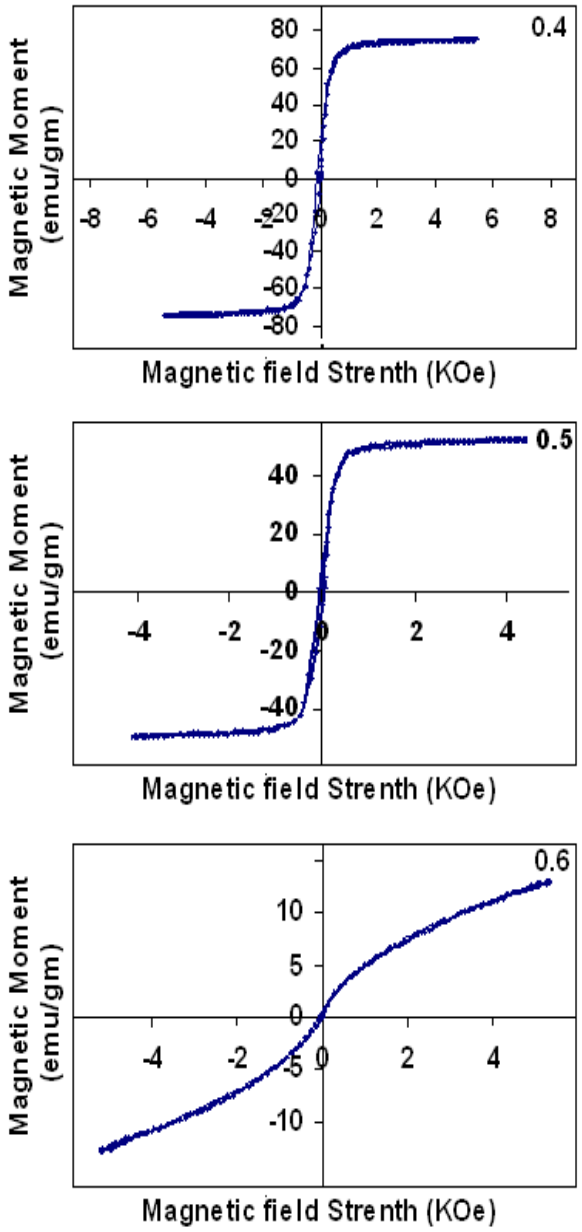


Fig 1.b)Variation magnetic field strength with magnetic moments for the system $MgZn_xMn_xFe2_{-2x}O_4$ for X = 0.4, 0.5, 0.6

CONCLUSIONS:

The saturation magnetization M_s initially increases and then decreases with Zn, Mn concentration 'x'.

REFERENCES ;

1. T. Abraham.A.M.Ceram.Soc. Butt.73 (1994)62.
2. V.R.K. Murthy, J. Vishvanathan.Science and technology of ferrite materials.
3. Z. Cvejic, S.Rakic, A. Kremenovic. B.Antic, C.Jovaletic P.Colomban.Solid State Sci. 8(2006) 908.
4. S. Hallynck, G. Pourroy, S. Vilminot, D. Autissier, H. Pascard, Solid State Sci. 8(2006)24.
5. S. A. Morrison, C. L. Cahill, E.E. Carpenter S. Calvin, V. Harris, J. Appl. Phys. 95(2004)6392.
6. X. Huang,Z.Chen,Solid State. Sci. 8(2006)24
7. N. Rezlescu, N. Iftimie, E.Rezlescu, C.Doroftie, P.D. Popa,Sens. Actuators B 114(2006)427.
8. E.C Sousa, M. H. Sousa, G.F. Goya, H. R. Rechenberg, J.Deperyrot, F.A.Tourinho,J. Magn. Magn. Mater 272(2004)1215.
9. L. John Berchmans, R. KalaiSelvan. C. O. Augustin,Mater. Lett. 58(2004)1928.
10. G.Srinivasana, V.M.Laletsinb, R.Hayesa, N.Puddubnayab,E.T.Rasmussena,D.J.Fekela, Solid state commun.124(2002)373.