

Review on magnetic nano ferrites and their composites as an alternative in Waste Water Treatment: Synthesis, modifications and applications

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Supplementary Material

Hessien *et al.* [36] synthesized $\text{SrFe}_{12}\text{O}_{19}$ by chemical co-precipitation method at calcination temperature of 900, 1000 and 1100 °C. Table 1 represents the effect of annealing temperature that influence size and different magnetic properties of prepared nano ferrites.

Table 1: Effect of annealing temperature on the formation, crystalline size and magnetic properties of $\text{SrFe}_{12}\text{O}_{19}$ powder precipitated at pH 10 for $\text{Fe}^{3+}/\text{Sr}^{2+}$ mole ratio: (a) 10 and (b) 9.23 annealed for 2 h. (Reproduced with permission from Ref. [36] Copyright © 2007 Elsevier B.V.)

$\text{Fe}^{3+}/\text{Sr}^{2+}$	Annealing temp. (°C)	% Phase change obtained	Crystalline size	Magnetic H_c (Oe)	Properties M_s (emu /g)	M_r (emu/g)
10.0	800	65% $\text{SrFe}_{12}\text{O}_{19}$ 35% Fe_2O_3	82.9 71.0	4524	50.64	27.06
	900	70% $\text{SrFe}_{12}\text{O}_{19}$ 30% Fe_2O_3	106.3 109.5	5060	55.18	29.85
	1000	70% $\text{SrFe}_{12}\text{O}_{19}$ 30% Fe_2O_3	128.3 189.4	5168	55.85	29.85
	1100	63% $\text{SrFe}_{12}\text{O}_{19}$ 34% Fe_2O_3	186.6 208.7	4779	56.9	31.31
9.2	800	92% $\text{SrFe}_{12}\text{O}_{19}$ 8% Fe_2O_3	114.5	4727	61.47	31.89
	900	100% $\text{SrFe}_{12}\text{O}_{19}$	98.0	5158	64.72	34.80
	1000	100% $\text{SrFe}_{12}\text{O}_{19}$	118.8	4434	84.15	45.04
	1100	100% $\text{SrFe}_{12}\text{O}_{19}$	158.8	2937	65.49	35.19

2.0 Metal and Their Oxide Deposition

Effect of metal and their oxide deposition affect crystallite size, morphology and magnetic properties of different nano ferrites. For example, Rashad *et al.* [60] prepared Sm substituted CoFe_2O_4 by citrate precursor method and studied the effect of Sm content on crystal

structure, crystallite size, morphology and magnetic properties of $\text{CoSm}_x\text{Fe}_{2-x}\text{O}_4$. Table 2 represents the effect of Sm ions content on crystal size and magnetic properties of prepared composites and the analysis revealed that the crystalline size of produced nano composite decreased by increase in Sm content and increased with increasing the calcination temperature from 400 to 1000 °C.

Table 2: Average crystalline size of produced $\text{CoFe}_{2-x}\text{Sm}_x\text{O}_4$ at different temperature from 400 to 1000° C where $x = 0.0\text{--}0.4$. (Reproduced with permission from Ref. [60] Copyright © 2007 Elsevier B.V.)

Temperature (°C)	Sm Content x (0.0–0.4)	Crystalline size (nm)
400	0.0	21.5
	0.1	14.9
	0.2	10.8
	0.3	9.4
	0.4	7.6
600	0.0	30.6
	0.1	18.8
	0.2	12.4
	0.3	10.8
	0.4	9.7
800	0.0	52.1
	0.1	33.7
	0.2	27.6
	0.3	25.5
	0.4	21.2
1000	0.0	85.9
	0.1	75.8
	0.2	61.9
	0.3	53.7
	0.4	50.9

