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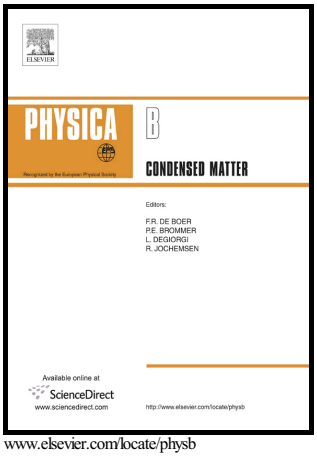

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PII: S0921-4526(17)30287-9
DOI: http://dx.doi.org/10.1016/j.physb.2017.06.001
Reference: PHYSB309979

To appear in: *Physica B: Physics of Condensed Matter*

Received date: 25 February 2017
Revised date: 8 May 2017
Accepted date: 1 June 2017

Cite this article as: Kamlesh V. Chandekar and K. Mohan Kant, Effect of size and shape dependent anisotropy on superparamagnetic property of $CoFe_2O$ nanoparticles and nanoplatelets, *Physica B: Physics of Condensed Matter* http://dx.doi.org/10.1016/j.physb.2017.06.001

Effect of size and shape dependent anisotropy on superparamagnetic property of $CoFe_2O_4$ nanoparticles and nanoplatelets

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Abstract:

Superparamagnetic cobalt ferrite ($CoFe_2O_4$) spherical nanoparticles and rhomboidal nanoplatelets were synthesized by co-precipitation at 80ºC (S1) and hydrothermal route at 150ºC (S2). X-ray diffraction (XRD) pattern confirms formation of cubic inverse spinel structure of as prepared cobalt ferrite samples (S1 and S2) with average crystallite size of 13 nm and 18.7 nm for S1 and S2 respectively. Transmission electron microscopy (TEM) reveals spherical and rhomboidal shaped with average particle size 16.7 nm (S1) and 19.8 nm (S2). The zero field cooled magnetization M_{ZFC} *vs.* T exhibit a broad maxima at $400K$ and 510 K for S1 and S2 respectively. The blocking temperature T_B is obtained as 310 K and 341 K for S1 and S2 respectively, by fitting coercive field at different temperatures to $T^{1/2}$ law. The morphology of S1 and S2 corresponds to shape dependence of continuum approach. The effective demagnetization factors estimated as $\Delta N_1 = 0$ and $\Delta N_2 = 0.749$ for S1 and S2 samples respectively. The uniaxial anisotropy and shape anisotropy observed to be dominant in spherical shaped and rhomboidal shaped $CoFe_2O_4$ nanoparticles respectively. The uniaxial anisotropy constant of S1 sample is estimated as 56 (kJ/m^3) at $T_B = 310K$ whereas the effective anisotropy constant for S2 sample is 627 (kJ/m^3) at $T_B = 341K$, in which shape

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