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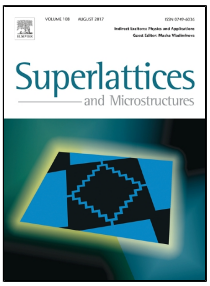

Strain induced magnetic anisotropy and $3d^7$ ions effect in $CoFe_2O_4$ nanoplatelets

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Strain induced magnetic anisotropy and $3d^7$ ions effect in $CoFe_2O_4$ nanoplatelets

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ABSTRACT

Cobalt ferrite ($CoFe_2O_4$) magnetic nanoplatelets were synthesized by hydrothermal method at 120°C (H120) and 180°C (H180) respectively. The formation of inverse spinel cobalt ferrite was confirmed by X- ray diffraction pattern (XRD) and Transmission electron microscopy (TEM). The X-ray diffraction studies shows the linear variation of microstrain with inverse crystallite size .The compressive microstrain of 0.024 and 0.016 was estimated for $CoFe_2O_4$ samples H120 and H180 respectively using Williamson-Hall (W-H) plot analysis assuming uniform deformation model. The valence state of metal ions and single phase formation single domain $CoFe_2O_4$ was confirmed by X-ray photoemission spectroscopy (XPS) and Raman spectroscopy. X-ray photoemission spectra (XPS) spectra exhibit Fe $2p_{3/2}$ peak and Co $2p_{3/2}$ peaks in both samples composed of two peaks corresponding to octahedral sites and tetrahedral sites. The strain induced magnetic anisotropy is estimated on basis of strain measured by W-H plot at 300K. The contribution of the Co^{2+} ions on octahedral sites of both samples of $CoFe_2O_4$ is assigned to the magnetostriction ions in cubic structure of cobalt ferrite by assuming ground state. The magnetic ions with $3d^7$ transition in $CoFe_2O_4$ lattice introduced the local magnetostriction through spin-orbit-lattice interaction with distorted cubic crystal field.