

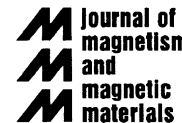


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Magnetic and optical properties of spinel $\text{Fe}_x\text{Co}_{3-x}\text{O}_4$ thin films

Kwang Joo Kim^{a,*}, Hee Kyung Kim^a, Young Ran Park^a, Geun Young Ahn^b,
Chul Sung Kim^b, Jae Yun Park^c

^a*Department of Physics and Center for Emerging Wireless Transmission Technology, Konkuk University, Seoul 143-701, Korea*

^b*Department of Physics, Kookmin University, Seoul 136-702, Korea*

^c*Department of Materials Science and Engineering, University of Incheon, Incheon 402-749, Korea*

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Abstract

Magnetic and optical properties of $\text{Fe}_x\text{Co}_{3-x}\text{O}_4$ thin films grown by sol–gel method have been investigated as the Fe composition (x) increases from 0 to 2. X-ray diffraction measurements revealed that the normal- and inverse-spinel phases coexist for $0.76 \leq x \leq 0.93$. The normal-spinel phase is dominant below $x = 0.76$ while the inverse-spinel phase above $x = 0.93$. The lattice constant of the inverse-spinel phase is found to be larger than that of the normal-spinel phase. For both phases the lattice constant increases with increasing x . The $\text{Fe}_x\text{Co}_{3-x}\text{O}_4$ films containing the inverse-spinel phase exhibit net magnetization that increases with increasing x . Conversion electron Mössbauer spectrum measured on the $x = 0.93$ sample showed that Fe^{2+} ions prefer the octahedral sites, indicating the formation of the inverse-spinel phase. Analysis on the measured optical absorption spectra for the samples by spectroscopic ellipsometry indicates a dominance of the normal-spinel phase for low x in which Fe^{3+} ions mostly occupy the octahedral sites. Observation of a crystal-field transition at 1.6 eV originating from tetrahedral Fe^{3+} ion confirms the existence of the inverse-spinel phase for high x .

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