

Mössbauer and optical investigation of $\text{Co}_{3-x}\text{Fe}_x\text{O}_4$ thin films grown by sol–gel process

Kwang Joo Kim · Hee Kyung Kim · Young Ran Park ·
Geun Young Ahn · Chul Sung Kim · Jae Yun Park

Published online: 14 November 2006
© Springer Science + Business Media B.V. 2006

Abstract Structural transformation and the related variation in magnetic and optical properties of $\text{Co}_{3-x}\text{Fe}_x\text{O}_4$ thin films grown by a sol–gel method have been investigated as the Fe composition varies up to $x=2$. The normal spinel phase is dominant below $x=0.55$ and the inverse spinel phase grows as x increases further. Conversion electron Mössbauer spectroscopy (CEMS) measurements indicate that the normal spinel phase have octahedral Fe^{3+} ions mostly while the inverse spinel phase contain octahedral Fe^{2+} and tetrahedral Fe^{3+} ions. For higher Fe composition ($x > 1.22$), Co^{2+} ions are found to substitute the octahedral Fe^{2+} sites. The measured optical absorption spectra for the $\text{Co}_{3-x}\text{Fe}_x\text{O}_4$ films by spectroscopic ellipsometry support the CEMS interpretation.

Key words spinel · structural transformation · Mössbauer spectroscopy · optical absorption