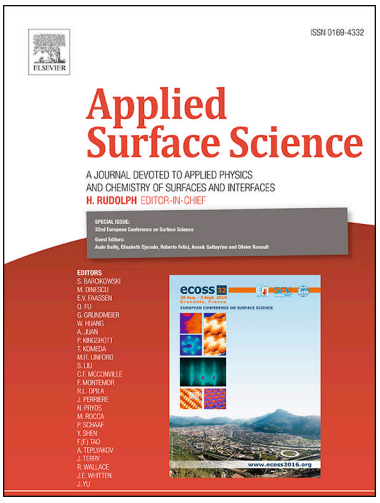

Full Length Article

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Effect of wavelength, deposition temperature and substrate type on cobalt ferrite thin films grown by pulsed laser deposition

M. Oujja[1*], L. Martín-García[1], E. Rebollar[1], A. Quesada[2], M.A. García[2], J.F. Fernández[2], J.F. Marco[1], J. de la Figuera[1], M. Castillejo[1]

[1]*Instituto de Química Física "Rocasolano", CSIC, 28006 Madrid, Spain*

[2]*Instituto de Cerámica y Vidrio, CSIC, 28049 Madrid, Spain*

**corresponding author: m.oujja@iqfr.csic.es*

Abstract

In pulsed laser deposition, the laser irradiation wavelength and the substrate nature and temperature crucially affect the composition, crystallinity, structure and magnetic properties of the grown deposits. In this work, cobalt ferrite ($CoFe_2O_4$) thin films were deposited on Si (100) and $SrTiO_3$ (100) single crystal substrates at room temperature and 770 K using laser wavelengths of 213, 532 and 1064 nm. The deposited films were characterized by atomic force microscopy to determine the surface morphology, by X-ray diffraction to examine their crystallinity, and by micro-Raman, scanning electron microscopy/energy-dispersive X-ray spectroscopy, X-ray photoelectron and Mössbauer spectroscopies to investigate their composition and stoichiometry. Magnetic characterization was carried out by superconducting quantum interference device magnetometry. At 770 K and 1064 nm, the films consisted of single-crystal $CoFe_2O_4$ ((100) orientation) when grown on $SrTiO_3$, and of polycrystalline $CoFe_2O_4$ when grown on Si. The composition of the films became more complex at shorter wavelengths as they contained magnetite and other minority phases in different concentrations. The crystalline quality of the films also decreased with decreasing wavelength even including superparamagnetic species. In general, for the same wavelength, the deposits