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Magnetic properties of $Y_{3-x}La_xFe_5O_{12}$ thin films grown by a sol–gel method

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Abstract

$Y_{3-x}La_xFe_5O_{12}$ thin films ($x = 0.0, 0.5, 0.75$) and powder ($x = 0.0, 0.25, 0.5, 0.75$ and 1.0) were fabricated by a sol–gel pyrolysis method and their magnetic properties and crystalline structures were investigated by using X-ray diffraction (XRD), atomic force microscopy, vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. Films with homogeneous garnet phases were obtained from stock solutions spun on SiO_2/Si (100) substrates and fired at 873–1073 K for 1 h in air. Results of X-ray diffraction show that the film had no preferred direction. The XRD patterns of $Y_{3-x}La_xFe_5O_{12}$ had only peaks of the garnet structure in case of substituting the concentration x less than 0.75. Those of $Y_2La_1Fe_5O_{12}$ consisted of peaks from garnet and $LaFeO_3$ structures. The microstructure of the films with a square shape consisted of 200–300 nm in size and 5–8 nm in surface roughness. The garnet had the largest saturation magnetization, about 34 emu/cm^3 , and the lowest coercivity, 27 Oe. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Sol–gel method; Mössbauer spectroscopy; Garnet structure
