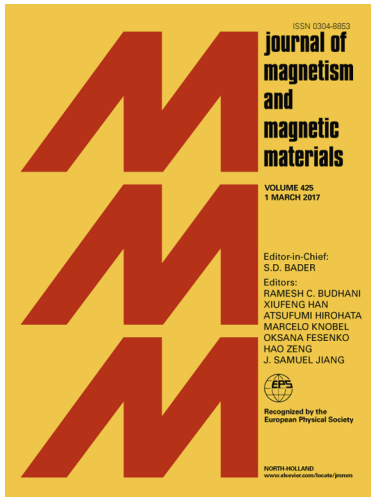

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Effects of Second Order Surface Anisotropy in YIG Sputtered onto GGG (100) oriented substrate

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ABSTRACT

In this work, we produced $Y_3Fe_5O_{12}$ textured films, with thicknesses between 50 nm and 500 nm, onto (100) $Gd_3Ga_5O_{12}$ by magnetron sputtering and post annealing, and investigated the first and second order surface and cubic anisotropy constants using the ferromagnetic resonance technique. The surface anisotropy constants exhibited different behaviors with film thickness, with the first order presenting the usual inverse of ferromagnetic layer thickness. Besides this inverse of thickness behavior, the second order also came up with a constant value. In the frame of spin reorientation transition phenomenon, we evaluated volume and surface contribution to the surface anisotropy. Although the second order cubic anisotropy constant is one order of magnitude stronger than the first order, they did not show any explicit thickness dependence. The second order terms of surface and cubic anisotropy appeared to be essential to allow simultaneous fit of in-plane and out-of-plane angular dependence of resonance field. Moreover, they had to be negative to describe the out-of-plane results correctly. Our results raised critical issues that shall be taken into account when explaining the new and recent spintronics and caloritronics effects in YIG.

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Keywords: ferromagnetic resonance, surface anisotropy, cubic anisotropy, second order anisotropy