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Sputtering Growth and Ferromagnetic Resonance Characterization of Nanometer-Thick Yttrium Iron Garnet films[1] TAO LIU, HOUCHEN CHANG, YIYAN SUN, MICHAEL KABATEK, MINGZHONG WU, Department of Physics, Colorado State University, VINCENT VLAMINCK, AXEL HOFFMANN, Materials Science Division, Argonne National Laboratory, LONGJIANG DENG, University of Electronic Science and Technology of China — High-quality nanometer-thick epitaxial yttrium iron garnet (YIG) films have been grown on gadolinium gallium garnet substrates by magnetron sputtering. The films had a thickness range of 5 to 30 nm and exhibited same crystalline orientation as the GGG substrates. The surface roughness of smooth films can be as small as 0.1 nm, which was very close to the roughness of GGG substrate. The ferromagnetic resonance (FMR) profiles can be fitted nicely with Lorentzian functions, but not with Gaussian functions. This indicated that the films had high uniformity. The FMR linewidth were in the range of 6 to10 Oe at 9.48 GHz and varied with both the sputtering and annealing conditions, as well as the crystalline structure of the GGG substrate. For films with very smooth surfaces, the FMR linewidth increased linearly with frequency and the damping constant was about 0.001. In contrast, for films with big grains on the surface, the linewidth-frequency response was strongly nonlinear.

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