Abstracts

Propagating Magnetic Waves in Epitaxial YIG

W.L. Bongianni, J.H. Collins, F.A. Pizzarello and D.A. Wilson. "Propagating Magnetic Waves in Epitaxial YIG." 1969 G-MTT International Microwave Symposium Digest of Technical Papers 69.1 (1969 [MWSYM]): 376-380.

The theoretical work of Damon and Eshbach leads to the prediction of magnetostatic surface and volume wave propagation in ferromagnetic slabs. Experimental work of Brundle and Freedman with slabs of flux-grown YIG have demonstrated the existence of both these wave classes. In this paper we report the use of YIG films grown by the method of chemical vapor deposition (CVD) on gadolinium gallium garnet to generate such waves. CVD allows films with thickness orders of magnitude smaller than those fabricated from flux-grown material to be obtained. The advantage of such thin films is the uniformity of internal dc field that can be obtained. Figure 1 is a plot of the demagnetizing field in a 1 cm x 0.5 cm YIG slab of varying thickness as calculated from the analysis of Joseph and Schlomann. The external dc field is along the z-axis. The demagnetization variation is shown along this direction from the face to the center of the slab. For a 10 micron thick film, approximately 60 percent of the distance along the z-axis varies by less than 1.0 oe and 95 percent by less than 10 oe. This is about two orders of magnitude less than a slab of 1 mm thickness, which is a typical thickness used by previous investigators. Measurements were made on epitaxial YIG films ranging in thickness from 4 microns to 50 microns. The ferromagnetic resonance linewidth of these epitaxial films has been measured and found to be typically 1.5 oe at X-band, when the bias field is applied perpendicular to the film plane.

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