Magnetostatic Wave Study of an YIG Film Grown by LPE Method

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In order to understand the magnetostatic wave modes of an YIG thin film, grown by a liquid phase epitaxy (LPE) method, we investigated the ferromagnetic resonance (FMR) spectra. When the static magnetic field was parallel to the film plane, the magnetostatic surface wave (MSSW) modes and the magnetostatic backward volume wave (MSBVW) modes were observed. However, when the static magnetic field was perpendicular to the film plane, the complex spectra were observed. The FMR spectra in parallel configuration can be well explained by the Walker [1] and Damon-Eshbach [2] model. The magnetic properties of the sample show a saturation magnetization of 136.7 emu/cc and an uniaxial magnetic anisotropy constant of 1,800 erg/cc. The resonance fields of the magnetostatic backward volume wave modes coincided with the theory. The resonance fields of the magnetostatic surface wave modes coincided with the theory at higher modes, but deviated gradually from the theory with decreasing mode number. In order to examine the temperature dependence of the magnetostatic surface wave modes and the magnetostatic backward volume wave modes, FMR experiments were carried out in the temperature range from 133 K to 473 K (temperature step is 20 K). As the temperature decreasing, the resonance field positions of the MSSW modes and the MSBVW modes move gradually to the low-field region with decreasing intensity. The intervals of the resonance field positions of the MSSW modes and the MSBVW modes increase as the temperature decreases up to 133 K. The saturation magnetization decreases gradually with increasing temperature in the range from 133 K to 473 K. The peak-peak line width of the magnetostatic wave (MSW) mode decrease with decreasing temperature in the range from 473 K to 353 K, and is almost constant in the temperature from 353 K to 213 K.

References

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