High frequency properties of patterned Fe-Al-O thin films

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1. Introduction

An application of ferromagnetic thin films for radio frequency and microwave components demands materials and structures with the resonance frequency higher than 1 GHz. If the resonance frequency of a thin film is lower than required, right patterning shifts the resonance to higher frequencies by creating new demagnetizing effects[1,2]. In this paper, we present calculated and experimental results illustrating this effect.

2. Experiments

Single-layered Fe-Al-O films of 400nm thickness deposited on Si wafer by RF-magnetron sputtering. The film were patterned into arrays of rectangular elements with different aspect ratios from 1 to 37 separated by constant spaces using conventional photolithography and wet etching. The high frequency permeability was measured by 1-turn coil method in the frequency range from 10 MHz to 2000 MHz.

3. Results and disscussion

The intensity of anisotropy field($H_{k\ eff}$) increase with increasing aspect ratio as shown in Fig.1. The increased effective anisotropy has a beneficial effect on the high frequency response of ferromagnetic films shifting their resonant frequency as shown in Fig. 2.

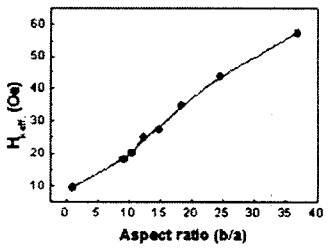

Fig.1. Measured anisotropy field of patterned films as a function of aspect ratio.

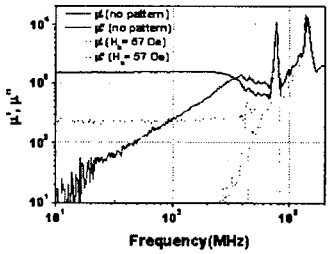

Fig. 2. Measured high frequency permeability of thin films with different anisotropy field.

References

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