Etch characteristics of CoZrNb and CoFeTb magnetic films in a high density plasma

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The development of nonvolatile memory such as magnetoresistive random access memory (MRAM) as well as the magnetic read/write heads based on giant magnetoresistance (GMR) requires the advanced patterning of magnetic thin films. As the density of these devices increases, the minimum critical dimensions of magnetic films and magnetic multilayer stacks should be also diminished. Currently the patterning of magnetic thin films and magnetic multilayer stacks has been carried out by ion milling or reactive ion etching. However, the ion milling process by energetic argon ion results in redeposition on the sidewall of the films and poor magnetic switching characteristics such as the reduction of MR ratio.

Recently, new magnetic films such as CoZrNb and CoFeTb have been applied to magnetic tunnel junction (MTJ) for the development of MRAM devices. In this study, the reactive ion etching of CoZrNb and CoFeTb magnetic thin films has been performed using a photoresist mask in an inductively coupled plasma. The Cl_2 and C_2F_6 gas chemistries were chosen and the etch characteristics were examined as a function of gas concentration in terms of etch rate, etch selectivity, and etch profile. Figure 1 shows the preliminary results in the etching of these magnetic films in a high density plasma of Cl_2/Ar.

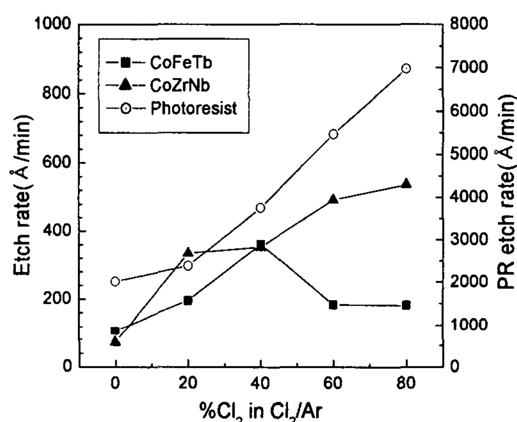

Fig.1. Etch rate of CoZrNb and CoFeTb films as a function of Cl_2 concentration.

References

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