

High-rate-deposition of Ni-Zn ferrite thin-films using ECR sputtering with conic target

Tomoharu Ogita¹, Setsuo Yamamoto^{*1}, Hiroki Kurisu¹, Mitsuru Matsuura¹,
Yoshihiro Shimosato² and Shigenobu Okada²

¹ Faculty of Engineering, Yamaguchi University 2-16-1 Tokiwadai, Ube, 755-8611 Japan

² SHIMADZU Corporation, 380-1 Horiyamasita, Hadano, 259-1304 Japan

*Corresponding author: e-mail: yamamoto@yamaguchi-u.ac.jp, Phone: +81 836 85 9621, Fax: +81 836 85 9621

It has been already reported that Ni-Zn ferrite thin-films for high frequency magnetic devices was successfully prepared at low temperature of 200 degrees C and relatively high deposition rate of 14 nm/min. by reactive sputtering method utilizing a dense and active electron-cyclotron-resonance (ECR) microwave plasma [1]. In our previous study, three 100 mm square Ni-Zn-Fe platelet targets were equipped in the vicinity of the plasma extraction window in the ECR sputtering apparatus. In this study, a conic target whose area is 2.5 times larger than the total area of the platelet targets were introduced to increase deposition rate.

Figure 1 shows the oxygen gas flow rate dependence of saturation magnetization (M_s) and deposition rate of ferrite thin-films in use of the three-platelet targets and in use of the conic target. Grey zone shows the expected saturation magnetization of Ni-Zn bulk ferrite with same composition as the target. Because of increased area of the target, use of the conic target brought us about 2.5 times higher deposition rate. To obtain ferrite thin-films with the reasonable M_s in the grey zone, use of the conic target needed about 2.5 times higher oxygen gas flow rate than the use of the platelet targets. At the oxygen gas flow rate of 13%, the ferrite thin-films with M_s of 290 emu/cc and low coercivity of 11 Oe could be deposited using the conic target at a high deposition rate of 44 nm/min.

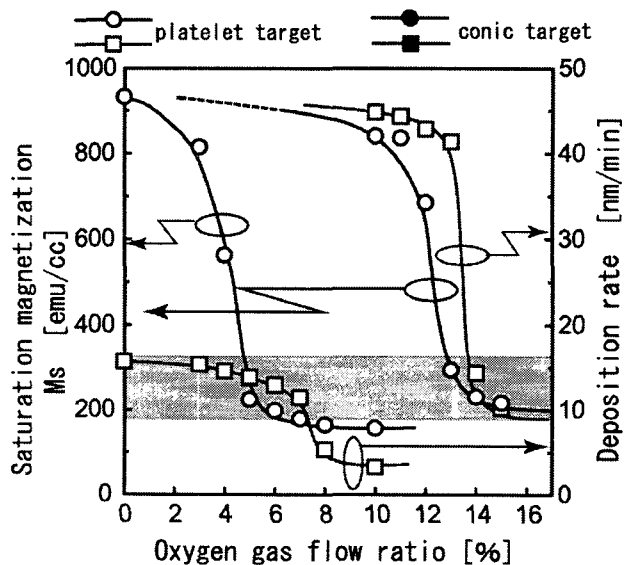


Fig.1 Oxygen gas flow ratio dependence of saturation magnetization and deposition rate of Ni-Zn ferrite films.

References

- [1] H. Wada, S. Yamamoto, H. Kurisu, M. Matsuura, and Y. Shimosato: "Low Temperature Sputter-Deposition of Ni-Zn Ferrite Thin-Films Using Electron-Cyclotron-Resonance Microwave Plasma," Transactions of the Materials Research Society of Japan, MRS-J, Vol.128, No.4, (2003). (in press)