Stress Changes of Binary CoNi Alloy Films Electrodeposited from Different Anions

R. Y. Song[1], D.-Y. Park[2,*2], J. M. Ko[1], N. V. Myung[3]

[1]Department of Chemical Technology,
[2]Department of Applied Materials Engineering,
Hanbat National University, Daejeon,
305-719, Republic of Korea

[3]Department of Chemical and Environmental Engineering, University of California at Riverside, Riverside, CA 92508, USA

Magnetic-MEMS devices such as magnetic recording heads, magnetometers, microactuators, micromotors, and frictionless microgears require the use of both hard and soft magnetic materials [1-4]. Among several different ways to deposit and integrate magnetic materials into MEMS devices, electrodeposition, one of the electrochemical processes, is the most successful way to meet the requirements of high yield, cost effective processes, and ability to control the film thickness from a few nanometers to millimeters.

Film stress plays an important role for integration of MEMS devices because, unlike in the data storage application, the deposit thickness of magnetic films in MEMS can range from nanometers (e.g. NEMS devices) to few millimeters thick (e.g. high aspect ratio microstructures using LIGA and SU-8 processes). In many cases, this film stress could exceed the strength of the film, resulting in cracking, deformation of devices, and interfacial failure. Therefore, it is very important to develop high performance soft magnetic materials with minimum film stress.

Figure 1 shows the changes of film stress in binary CoNi thin films as a function of Co ion concentration in chloride and sulfate baths. Films without saccharin content for both chloride and sulfate baths always shows tensile stress. However, films with saccharin content for both chloride and sulfate baths shows the changes of film stresses from compressive to tensile mode.

In this presentation, the stress changes as a function of several deposit parameters for baths with different anions such as chloride, sulfate and sulfamate will be discussed.

References:

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[2] Corresponding author: dypark@hanbat.ac.kr

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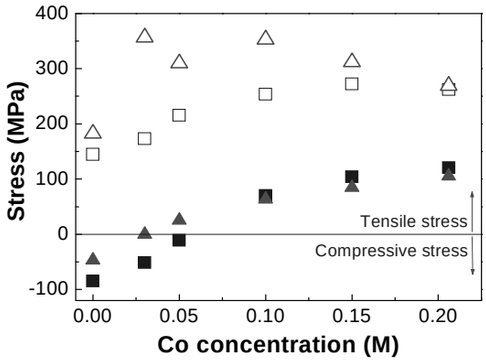

Figure 1. Dependence of film stress on Co ion concentration electrodeposited from chloride and sulfate baths. For chloride bath: 0.2 M $NiCl_2$+ 0 - 0.206 M $CoCl_2$ + 0.7 M NaCl + 0.4 M H_3BO_3 (□ 3μm film thickness without saccharin, ■ 3μm film thickness with 0.01 M Saccharin). For sulfate bath: 0.2 M $NiSO_4$+ 0 - 0.206 M $CoSO_4$ + 0.7 M Na_2SO_4 + 0.4 M H_3BO_3 (△ 2μm film thickness without saccharin, ▲ 2μm film thickness with 0.01 M saccharin).