

Resonant Change in Element Contents and Crystal Structure Change in Co–Ni–Fe Thin Films Electrodeposited Using Rectangular Pulse Current over Megahertz Frequency Range

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Co–Ni–Fe thin films electrodeposited by a rectangular pulse current technique within a frequency range from 0.1 to 1.2 MHz were investigated using energy dispersive X-ray microscopy and X-ray diffraction. The Fe, Ni, and Co contents in the Co–Ni–Fe films rapidly increased at resonant frequencies. The number of resonant frequencies was odd, and was explained by an energy-level transition. With an increase in the Fe content, the crystal structures of the Co–Ni–Fe thin films changed from the hexagonal closed-packed (HCP) crystal structure, to an amorphous structure, and further to the body-centered cubic (BCC) crystal structure.

Keywords: Co–Ni–Fe thin film; Resonant frequency; Energy level transition; HCP; Amorphous structure; BCC

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