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In situ magnetoelastic coupling and stress-evolution studies of epitaxial $Co_{35}Pd_{65}$ alloy films in monolayer regime

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One of interesting studies in the area of ultrathin ferromagnetic films is to investigate the magnetoelastic properties, since a number of experimental and theoretical works have reported that the magnetoelastic contribution to the magnetic properties is very important in ultrathin magnetic films. In this study, we have investigated magnetoelastic properties of epitaxially grown $Co_{35}Pd_{65}$ alloy films on Cu/Si(001) in monolayer regime. Our study was performed in an ultrahigh vacuum(UHV) chamber equipped with a highly-sensitive optical deflection-detecting system for in situ magnetoelastic coupling and stress measurements, a submonolayer-resolution surface magneto-optical Kerr effects(SMOKE) measurement system, and a reflection high energy electron diffraction(RHEED) imaging system.

The magnetoelastic coupling(B2) of $Co_{35}Pd_{65}$ alloy films was measured in the thickness range from 1 ML to 10 ML with a submonolayer sensitivity. It was found to sensitively increase from 0.72×10^7 to 3.31×10^7 J/m^3 with increasing the $Co_{35}Pd_{65}$ layer thickness. Especially, simultaneous in situ measurements of magnetoelastic coupling and stress revealed that a second-order strain correction is essential to describe the dependence of magnetoelastic coupling on film strain in this system. The present study also revealed that formation of three dimensional islands is a dominating stress relaxation mechanism in Co35Pd65 alloy films.

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