LOW STACKING FAULTS CoPtRu ALLOY AS A BUFFER LAYER MATERIAL FOR PERPENDICULAR MAGNETIC RECORDING MEDIA

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I. INTRODUCTION

Uniaxial crystal symmetry of Co-based ferromagnetic crystal grains is important for various magnetic devices such as magnetic recording media. It has been pointed out that the uniaxial magnetocrystalline anisotropy energy (K_u) of the Co -based alloy film has remarkably decreased when stacking faults (SFs) are introduced into the Co alloy grains [1]. However, only few papers reported about quantitative evaluation of degree of SFs in the Co alloy experimentally [2, 3]. We have found and established quantitative evaluation method for the structure with SFs in the *c*-plane oriented hexagonal phase (hereafter abbreviated as pseudo hcp) by a laboratory-scale X-ray diffractometer (XRD) [4-8]. When this evaluation method is applied to Co-Pt-Cr sputtered film formed on Ru underlayer at room temperature, it revealed that hexagonal stacking is stabilized at limited composition region with (Cr + Pt) concentration of 15-30 at% [9]. In this report, the degree of SFs was quantitatively evaluated for the Co-Pt-Ru pseudo hexagonal film in which Cr was replaced with Ru for the purpose of stabilizing the hexagonal stacking of Co-Pt alloys.

II. RESULTS AND DISCUSSION

Figure 1 shows the in-plane XRD profile for (a) $Co_{100-x}Pt_x$ and (b) $Co_{100-x}Ru_x$ alloy films with various *x*. It should be noted that *c*-plane orientation of all samples was confirmed by an out-of-plane XRD profile. For (a), diffraction from the hexagonal (10.0) plane is very weak for the film with $x = 0$ at.% (pure Co), and the intensity of the diffraction from (10.0) plane gradually increases as *x* increases until $x = 30$ at.%, and it decreases with increasing *x* from 30 to 100 (pure Pt) at.%. Increase of diffraction intensity from (10.0) plane in $x = 0$ to 30 at.% indicates that reduction of SFs in the hcp Co-Pt alloy due to increase of valence electron number [7]. Decrease of the diffraction from (10.0) plane suggests that excessive addition of Pt atom leads to collapse of the hcp atomic stacking. On the other hand, for (b), the diffraction from (10.0) plane increases with increasing *x* from 0 to 100 (pure Ru) at.%. This result shows that addition of Ru atoms stabilizes the hcp atomic stacking of the Co-Ru alloy.

Fig.2 shows the dependence of a corrected intensity ratio on the additional element concentration for the Co-Pt-Ru alloy film. The corrected intensity ratio is a value obtained by correcting the diffraction intensity ratio of the (10.0) plane and the (11.0) plane of the pseudo-hexagonal film with the atomic scattering factor, the Lorentz polarization factor, and the irradiation area [7]. Value of the corrected intensity ratio becomes 0 for the perfect face-center-cubic stacking, and becomes 0.25 for the perfect hcp stacking. Composition range where the corrected intensity ratio is 0.20 or more largely expanded from the Ru side, and thus Ru addition tends to stabilize the hcp stacking of the Co-Pt based alloys compared with Cr addition [9]. In the presentation, magnetic properties of Co-Pt-Ru alloy films, structure and magnetic properties of the Co-Pt-Ru-oxide granular film are also reported.

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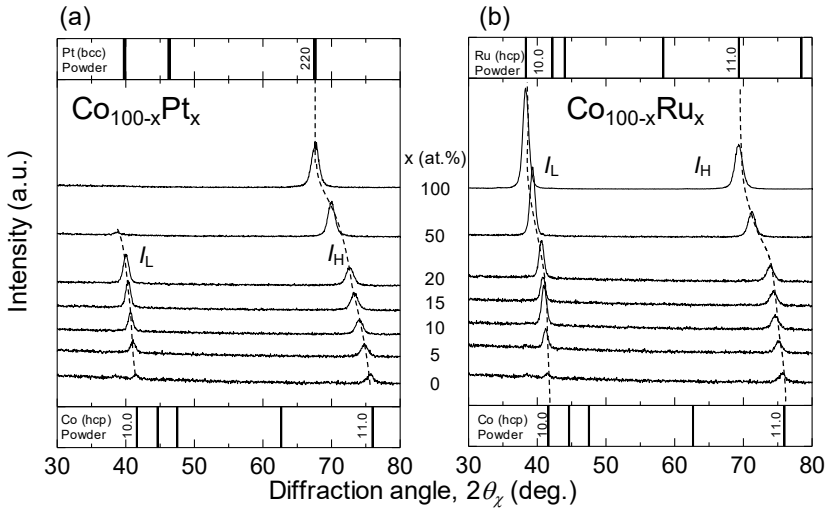

Fig. 1 In-plane XRD profiles for (a) $Co_{100-x}Pt_x$ and (b) $Co_{100-x}Ru_x$ films.

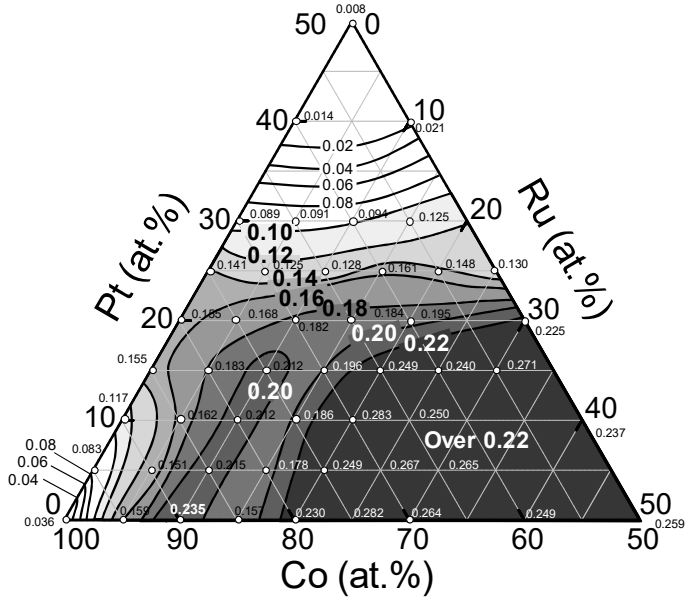

Fig. 2 Composition dependence of corrected integrated intensity ratio for *c*-plane oriented Co-Pt-Ru films.