Magnetic and structural analysis of Pt/Co thin films deposited on Si/SiO_2 substrates annealed by RTA

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Co-Pt binary alloys, such as Co_3Pt, CoPt and $CoPt_3$, have been attracted much attention because of their high uniaxial magnetocrystalline anisotropies, high coercivities and low ordering temperatures, looking ahead to future applications mainly for high density magnetic recording media. They also have potential ability for nanoscale devices such as ferromagnetic single-electron transistors due to immune to thermal fluctuation of magnetization in sub-10 nanoscale structures. It is reported that Co-Pt alloys show ordered and disordered crystalline structures, different orientations and magnetic properties, depending on fabrication processes including deposition and annealing, compositions, stacking structures, thicknesses, substrates and so on. Therefore, towards the applications to nanoscale devices, comprehensive understanding of their magnetic and structural properties in particular nanostructures is necessary. Here, we fabricate Pt/Co thin films onto thermally-oxidized Si substrates with Ti layer deposited by electron-beam evaporation. These films are subsequently annealed by rapid thermal annealing (RTA) to make ferromagnetic Co-Pt alloys. The surface morphologies of the films are observed by a scanning electron microscope (SEM). Their crystalline structures and magnetic properties are also characterized by X-ray diffraction (XRD) at KEK (BL-8B) and a vibrating sample magnetometer (VSM), respectively. From the SEM images, clear change in surface morphology between the films before and after annealing at above 400 °C is observed, shown in Fig. 1. The M-H loops of the films before and after annealing at 400 °C are shown in Fig. 2, indicating that the annealing makes Co-Pt alloys with larger saturation magnetization.

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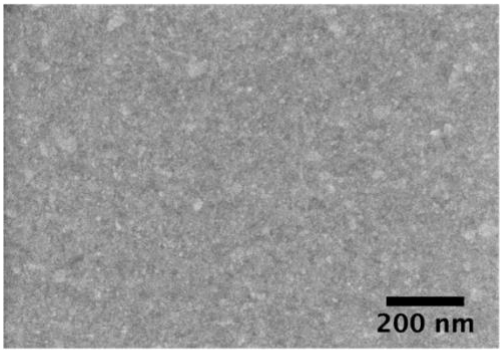

Fig. 1. SEM image of the film annealed at 400 °C.

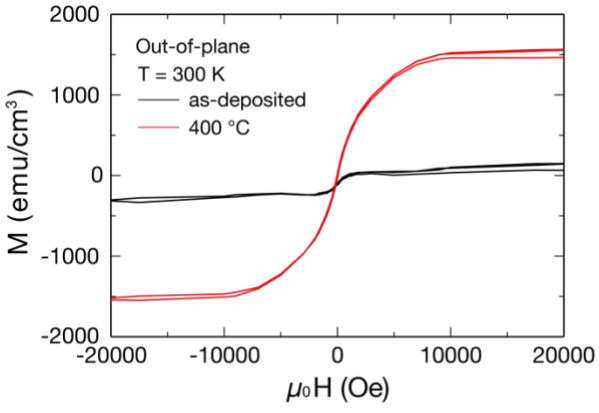

Fig. 2. M-H loops of the films before and after annealing at 400 °C.