(001)配向した $L1_0$-CoPt/TiN 多層膜の垂直磁気異方性

Highly (001) textured $L1_0$-CoPt/TiN multilayer films with perpendicular magnetic anisotropy

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To obtain strong perpendicular magnetic anisotropy (PMA) based on $L1_0$ structure for magnetic storage devices, costly single crystalline substrates are generally required in most cases in order to obtain (001) texture. Recently, various studies also have focused on depositing different kinds of seed layers on glass or other amorphous substrates to promote (001) preferred orientation of $L1_0$ CoPt and FePt. TiN is a promising candidate for the seed layer material because of its cubic crystalline structure (similar to MgO) and excellent diffusion barring property even at high temperatures. In the present work, highly (001) textured $L1_0$-CoPt/TiN multilayer films have been successfully deposited on glass substrates. As shown in Fig. 1, after annealing at 700 °C, the multilayer film exhibits strong PMA. Alternate deposition of cubic TiN and CoPt effectively improves the crystallinity and (001) preferred orientation of CoPt layers. This effect is verified by the substantial enhancement of (001) preferred orientation, increasing of magnetic energy and remanence squareness with increasing the period number of the multilayer films. As shown in Fig. 2, TiN layers near the top surface of the multilayer film show much better crystallinity and (100) preferred orientation than the bottom 5 nm TiN layer. CoPt layers also show improvements in crystallinity and preferred orientation.

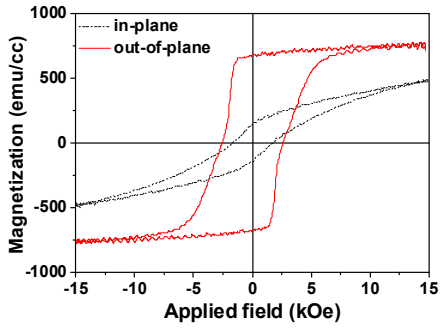

Fig. 1. *M-H* curve of TiN(5 nm)[CoPt(4 nm)/TiN (2 nm)]$_{15}$ multilayer film after annealing at 700 °C.

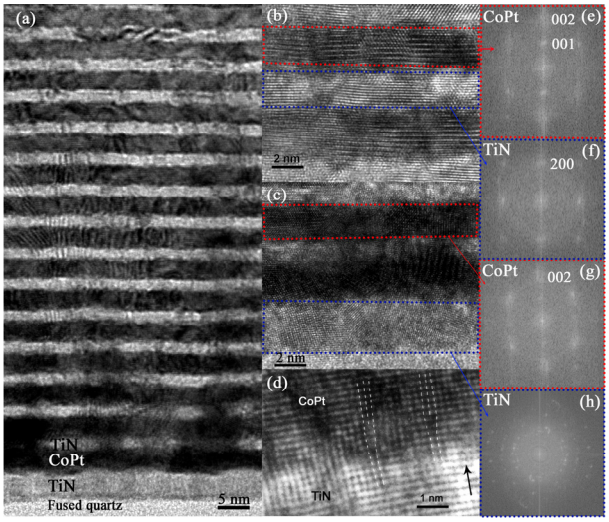

Fig. 2. TiN(5 nm)[CoPt(4 nm)/TiN(2 nm)]$_{15}$ multilayer film after annealing at 700 °C: (a) TEM image of the layered structure; (b) HR-TEM image of the top part; (c) HR-TEM image of the bottom part; (d) HR-TEM image of the interface between CoPt and TiN layers; (e), (f), (g) and (h) FFT results of TiN and CoPt of the selected areas.