Applications of sputter film deposition using a UHV technology: Fabrication of New Materials and Wafer-Bonding Techniques

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I have been expanding my study of two applications of sputter film deposition using a UHV technology: fabrication of magnetic films having high uniaxial magnetic anisotropy K_u, and development of room-temperature bonding techniques for use in fabricating wafers.

The former study is aimed mainly at realizing high-capacity magnetic storage and memory devices. My co-workers and I fabricated $L1_1$ type Co–Pt ordered alloy films, a quasi-stable phase, on glass wafers. We also fabricated high-quality $L1_0$-type ordered films at low temperatures of 200–300°C. We have been studying structural and magnetic properties of these high-K_u films and dot arrays of these films.

Atomic diffusion bonding of two flat wafers at room temperature is the latter study. Very thin metal films were fabricated on two flat wafer surfaces using sputter deposition, with subsequent bonding of the two metal films on the wafers in vacuum. The 2–4 inch wafers were bonded at room temperature over the entire bonded area using various metal films, even with films of 0.2 nm thickness. We have been investigating the potential of bonding for application to device fabrication.

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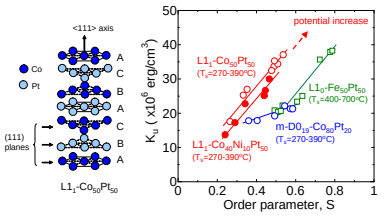
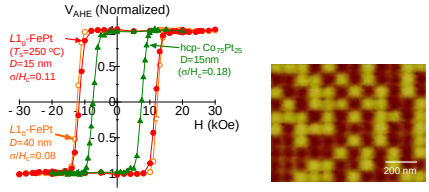
Fabrication of magnetic films having high uniaxial magnetic anisotropy K_u

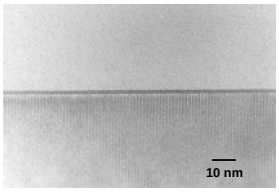


A significant potential increase in K_u by enhancing the ordering in $L1_1$ type Co-Pt based ordered alloy films.

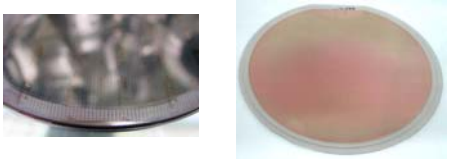


Magnetization curves for $L1_0$-FePt (5 nm) dot arrays with dot diameters D of 40 and 15 nm.

Development of room-temperature bonding techniques for wafers (Atomic Diffusion Bonding)



TEM cross-section image of bonded synthetic quartz (SiO_2) crystal wafers with Ti(0.5 nm)–Ti(0.5 nm) films.



Bonded wafers (4 inch diameter) having electric devices on one wafer surface using Ti (0.4 nm) films

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