

Glassy alloy composites for IT applications

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Abstract – Precisely aligned nano-hole arrays with a hole diameter of 30 nm and a pitch of 60 nm was fabricated using a Pd-based glassy alloy thin film and electron-beam lithographed Si mould by a thermal imprinting technique. Morphological evaluation reveals that the imprinted holes have a depth of 21 nm and flat bottom planes with an average roughness (Ra) of less than 1 nm. Reusability of the Si mould and short pressing time of less than 10 second will promise to realize highly processable replication.

For achieving high mobility and sophisticated function, recent progresses of information technologies are remarkable. As according to such evolutions, requirements for materials are getting severe. For instance, data density of storage media such as HDD is drastically increased [1]. The materials for applications are required even in nano-level structural control. In such circumstance, composite of multi-layered glassy alloy thin film is expected to satisfy such requirements by utilizing of their viscous deformability [2-3] and magnetic properties [4].

Pd-Cu-Ni-P thin film with a thickness of 25 nm was prepared by a pulsed-laser-deposition method. XRD and DSC measurements reveal that the thin film has an amorphous structure and the same thermal characteristics including glass transition behavior as that of melt-quenched sample. By utilizing the glassy alloy thin film and electron-beam lithographed Si mould with a dot diameter of 30 nm, a periodic nano-hole array was obtained by thermal imprinting. Figure 1 shows the SEM image of prepared nano-hole array with a hole diameter of 30 nm, showing that precise replication could be carried out within the pressing time of even in 10 seconds. By filling Co/Pd nano-multi-layer as magnetic recording materials into the holes, magnetization reversal behavior of the nano-composite was investigated. As a result, it is found that the filled each hole acted as nano-sized single-magnetic-domain and the composites can be applicable to perpendicular magnetic recording.

In this paper, we intend to present and discuss the possibility of the glassy alloy thin film periodic nano-hole array for the application high-data-density bit-patterned-media.

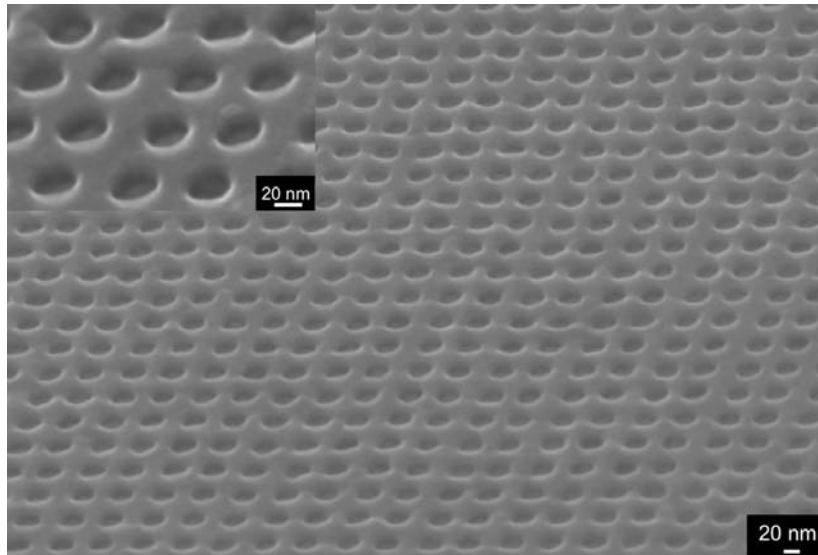


Figure 1 Pd-based glassy alloy nano-hole array with a hole diameter of 30 nm fabricated by thermal imprinting

References

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