NEW SCHEMES FOR BIT PATTERN MEDIA

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Bit pattern media (BPM) is a possible technology to extend hard disk drive recording capacities [1]. Here, a well ordered assembly of magnetic nanostructure is artificially fabricated in order to store one bit of information per nanodot. During my talk, I'll first introduce BPM technology, then present the main scientific challenges in the way of using this technology. I will especially focus on two points: 1) switching field distribution and stability issues; 2) patterning issues.

The origin of switching field distribution (SFD) in large arrays of magnetic nanostructures, i.e. the difference of reversal field from one nanostructure to another, has recently attracted great interest in the view of developing new generations of high density or high speed memories such as bit patterned media and MRAM. Indeed, in these memory designs, bit-to-bit variations in the structural and/or magnetic properties may produce unintended reversal when writing a hard switcher bit or on the contrary allows neighbours to be over-written if these have a lower reversal field [1]. More generally, the control of the switching field as independently as possible from the thermal stability is targeted. We used [Co/Pd]-based multilayers deposited onto pre-patterned substrates to develop new way to understand and control switching field distribution in nanostructures [2]. Magnetic properties of nanodots arrays up to 1 Tb/in^2 have been studied. Different SFD origins (dipolar coupling, pre-patterned array quality, and magnetic media growth defects) have been identified and solutions have been proposed for lowering them [3, 4]. I will particularly focus on new exchange coupled composite structures (so-called ECC media) that allow tuning both reversal field and SFD [5, 6].

BPM fabrication schemes mostly involve either lithographic patterning or combination of e-beam lithography methods with other techniques such as electrodeposition and self-assembling block copolymers. Lithographic techniques are expensive and time-consuming. Therefore, it is of interest to develop a non-lithographic patterning method based on self-assembly as an alternative route in order to develop a fast and cheap process capable of producing dense arrays of nanostructures over millimeter wide areas with precise long range order [1,7]. I will present a new method to fabricate ordered Co/Pt multilayer nanodot arrays using the barrier layer of anodic alumina templates as two-dimensional curved substrates [8]. Large area patterning of self-assembled alumina nanobumps are formed with hexagonally close-packed order. The subsequent deposition of Co/Pt multilayers on this bumpy surface leads to an ordered array of single-domain nanocaps magnetized perpendicularly to the sample surface. I will discuss their structural and magnetic features.

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