Centre de Nanosciences et de Nanotechnologies

Séminaire

Mercredi 04 octobre
11 heures
Salle 44 (Pierre Grivet) du C2N site Orsay

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" Heat Assisted Magnetic Recording Technology – Background, Status and Future"

Résumé:
Heat-assisted magnetic recording (HAMR) media requirements and challenges to extend the areal density (AD) beyond 1.4 Tb/in^2 [1] will be discussed. Industry research efforts started in 2000 and Hard Disk Drives (HDD) with capacities beyond 10 Terra-Bytes (TB) per disk drive are expected in 2018 [2]. Key progress efforts beyond recording media are related to read-write heads, head-disk interface (HDI) and channels. Today's channels allow experimental bit-error rates (BER) down to 10^{-2} [1].

Todays HAMR media are based on granular high magnetic anisotropy chemically ordered, well textured and chemically isolated $L1_0$ FePtX-Y films of about 12 nm average thickness. This is achievable by sputter co-deposition of FePt with grain segregants, Y, like C, BN, SiO_2 or TiO_2 (carbides, nitrides, oxides). Such segregants laterally exchange-decouple grains and make them permanent magnets with up- or down orientation. Six to ten of such grains form one bit with either up (=1) or down (=0) orientation.

Key ongoing progress efforts include average grain diameter <D> reduction from 8 to 4 nm, grain diameter distribution reduction Δ_D/D from 20 to 10 % and Curie temperature distributions Δ_{TC}/T_C below 3%. Research and development efforts are adjusting / optimizing T_C to the available near field transducer (NFT) laser heat power by doping FePt with Cu or Ni. Thin seed layers like 10 nm thick fcc MgO (100) are important to facilitate the formation of well-oriented grains with high chemical ordering and proper perpendicular magnetic anisotropy $K_u > 5.10^7$ erg/cm^3 [3]. All this is expected to increase AD up to about 4 Tb/in^2 [3]. Other, primarily modeling efforts, predict at least 10 Tb/in^2 AD HAMR technology, e.g. based on exchange coupled continuous ECC media, which will also be highlighted.

[1] Ganping Ju et al., IEEE Trans Mag. 51, 3201709 (2015)
[2] Mark Re, Seagate (2016)
[3] D. Weller et al., pss A, 210, 1245, (2013) & D. Weller et al., IEEE Trans Mag 50, 3100108 (2014)