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$L1_0$-FePt based systems for ultra high-density magnetic recording

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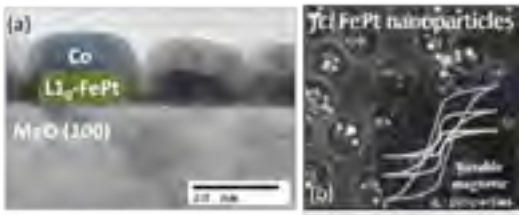
The demand for digital storage devices is continuously growing in response to the extraordinary increase of the volume of data created worldwide, which would reach the value of 40 zettabytes in 2020. Among the different storage devices currently available, the hard disk drive (HDD), based on the magnetic recording technology, remains the most convenient (cost/GB 0.02 $) and diffusive devise (~400 millions of units sold in 2016) for massive digital data storage. Currently available HDDs using CoCrPt:SiO_2 granular thin films with perpendicular magnetic anisotropy are reaching their physical limit (~1 Tbit/in_2 recording density) due to thermal fluctuations that hinder a further reduction of in-plane grain size (to 4–5 nm) needed to scale down the bit size. $L1_0$-FePtX alloy is currently considered the most promising candidate for future recording media with areal densities above 1 Tbit/in_2 thanks to its high magneto-crystalline anisotropy, which enables it to be thermally stable even at grain sizes down to 3 nm. However, its huge anisotropy implies an increase of the switching field, which cannot be afforded by current available write heads. The writability and thermal stability requirements can be simultaneously addressed by using exchange coupled composite systems, combining two or multiphase magnetic hard and soft materials, where the hard phase provides thermal stability and the soft phase reduces the switching field. An alternative approach involves the use of so-called bit patterned media, which consist of an ordered two-dimensional array of individual magnetic nanostructures with perpendicular anisotropy, each of them representing one bit of information, obtained by nanolithography and/or self-assembly techniques. This communication reports on the fabrication and physical properties of FePtX-based thin films and nanoparticles of potential interest for next generation recording media based on exchange coupled composite materials and bit patterned magnetic recording technology.



(a) Soft/hard Co/$L1_0$-FePt exchange coupled composite films (ref. 3) (b) Array of $L1_0$-FePt nanoparticles obtained by templated-assisted lithography (ref. 5).

Biography

Gaspare Varvaro has done his PhD in Material Science 2007, University "La Sapienza" of Roma, Italy. He works as a CNR Researcher since 2010. He is a member of the Nanostructured Magnetic Material Lab (ISM – CNR) and Head of the Thin Film Deposition Lab since 2015. His interests span from the fabrication to the characterization of magnetic and magneto-transport properties and their correlation with morpho-structural properties of nanostructured magnetic materials including single-phase, magnetic composites and hybrid/multifunctional systems (thin films, multilayers, nanoparticles and nano-patterned systems) for fundamental studies and applications (information storage, energy, sensors and biomedicine). His research activity is witnessed by more than 40 papers on ISI journals and conference proceedings and 2 book chapters. He is co-editor of a book titled "*Ultra-High-Density Magnetic Recording: Storage Materials and Media Designs*".

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