Bit patterned magnetic nanostructures by DNA nanolithograhy for ultra high density magnetic recording media

IMDEA - Nanociencia Institute

www.nanociencia.imdea.org

CENTRE DESCRIPTION

IMDEA Nanociencia is a young interdisciplinary research centre dedicated to the exploration of basic nanoscience and the development of applications of nanotechnology in connection with innovative industries.

Our purpose-built building was inaugurated in 2014 and features state-of-the-art facilities for 21st century science, where the frontiers between fields disappear and Physics, Chemistry, Biology, Engineering, and Medicine merge. It features more than 30 operative laboratories with over € 16 M worth of equipment -including the Centre for Micro and Nanofabrication. We are located at the UAM Campus, with access to all the facilities of one of Spain's largest and most prestigious Universities. The UAM Campus is just a few minutes away from Madrid's lively city centre, connected by "cercanías" trains and several bus lines.

We are over 150 scientists, with different professional and personal backgrounds. Approximately 40% of our PhD and postdocs come from outside Spain, representing every corner of the world, from Germany to China, from the USA to Singapore –a true international environment in which to develop your scientific career. Women make up 36% of our scientific and 62% of our management staff. No matter who you are or where you come from, you will feel welcome from the very first minute.

We take science seriously and value quality over quantity. Our scientists enjoy tackling complex multidisciplinary problems, often within in-house collaborations, so all of our students receive truly interdisciplinary training. We also enjoy publishing in the very best journals, with >200 publications a year, and an institutional h index of 79. Check out our webpage http://nanociencia.imdea.org/, facebook @IMDEANanociencia or twitter @IMDEA_Nano for more information.

So if you are a talented, hard-working individual with a real interest in Science, IMDEA Nanociencia is the right place for you! Come work with us!

ADDRESS

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AREA OF KNOWLEDGE

Physical Sciences, Mathematics and Engineering

GROUP OF DISCIPLINES

LIFE SCIENCES

Industrial Engineering, Mechanics, Metallurgy, Materials, Nanotechnology, Aeronautical, Naval and Aerospace Engineering

GROUP LEADER

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Research project/ Research Group description

This project addresses the key challenges of magnetic media, targeting the potential for the ultimate frontier of magnetic data storage, where a single bit is supported by the smallest magnetic islands with a thermally stable magnetisation. The vision of this project is to achieve and combine breakthroughs that will create a new technology for bit patterned magnetic nanostructures based on DNA lithography and DNA molds casting. Isolated magentic islands will be either patterned by DNA direct nanolithographic techniques combined with manetic metal tilt deposition or casting FePt nanoparticles with DNA molds to form ordered magnetic nanostructures. Statistic and dynamic magnetic switching properties of the media will be characterized by different techniques such as magnetic force microscopy (MFM), magneto-optical Kerr effect (MOKE) and scanning transmission x-ray microscopy (STXM). In addition, the recording performance will be investigated by AFM probe recording. Prerequisite for achieving the above technological goal is not only the final performance in practical technological applications, but also an improved understanding of magnetic phenomena at the nanoscale (in thin films, nanoparticles, nanodots), which is the intrinsic scientific content and objective of the project.

TRAINING CAPACITY OF THE GROUP：(1) Semiconductor fabrication processes in clean room environment: Intensive knowledge and on-hand experiences in semiconductor micro- and nanofabrication, including mask design, lithography (photolithography, laser interference lithography, electron beam lithography, extreme ultraviolet interference lithography), thin film deposition (sputtering, electrochemical deposition, and epitaxial growth such as atomic layer deposition, MBE and PLD), all kinds of wet or dye etching processes and corresponding process inspection. (2) Magnetic thin film deposition techniques.

Job position description

(1) Patterned magnetic nanostructures with period down to sub-10 nm over micrometer size by DNA nanolithography: Fabrication of pre-patterned DNA hole substrate with period down to sub-10 nm by DNA self assembled building blocks over large area. Using these DNA nanostructures as the direct protection mask, patterned magnetic Fe/Pt nanostructures can be fabricated over micrometer isze.With post annaeling, FePt alloy will be obtained.
(2) Patterned magnetic nanostructures with period down to sub-10 nm over micrometer size by DNA mold casting: Colloidal synthesized FePt nanoparticles can be casted by designed DNA molds with differnt period over micrometer size.
(3) Structural and magnetic characterization of patterned magnetic nanostructures: Advanced sample characterization will be performed to investigate the magnetic and structural properties of each individual magnetic arryas. Of particular interest are the SFD, thermal stability, and magnetization reversal of selected nanocap arrays.

WP1-Patterned nanostructures by direct nanolithography with periods down to sub-10 nm over large areas: KT1 Fabrication of pre-patterned DNA hole substrate with period down to sub-10 nm by DNA self

assembled building blocks over large area; KT2 Patterned nanostructures by direct nanolithography with periods down to sub-10 nm over large areas; KT3 Post annealing process for high magnetic anisotropy of FePt mangetic nanostructures

WP2- Patterned magnetic nanostructures with period down to sub-10 nm over micrometer size by DNA mold casting: KT4 Fabrication of pre-patterned DNA hole molds with period down to sub-10 nm; KT5 Patterned magnetic nanostructures with period down to sub-10 nm over micrometer size by DNA mold casting

WP3-Microstructure and magnetic property investigations: KT6 Microstructure characterization; KT7 Magnetic characterization.