Magnetic and Electrical Control of Magnetic Films

Tech ID: 23589 / UC Case 2013-022-0

BACKGROUND

Controlling the magnetic properties of ferromagnetic (FM) layers without magnetic fields is an on-going challenge in condensed matter science with multiple technological implications. External stimuli (e.g., light, electric field) and proximity effects (e.g., materials susceptible to external driving forces) are the most used methods to control the magnetic properties. An interesting possibility along these lines is offered by ferromagnets in proximity to materials that undergo metal-insulator (MIT) and structural phase transition (SPT). SPT and MIT are usually driven by temperature but they may also be driven by current, light and pressure. Thus, if the magnetism of the FM is affected by the proximity to materials that undergo MIT, then tuning the magnetic properties by multiple stimuli may become possible.

TECHNOLOGY DESCRIPTION

University researchers have developed methods, materials and devices that pertain to: (i) controlling and tailoring the magnetic and electrical properties of magnetic films by growing them on top of materials that undergo structural phase (SPT) and metal-insulator transitions (MIT), and (ii) use of these transitioning “active layers” in read/write processes for magnetic memory devices or transistor device. In the invention, variation in temperature induces large stresses in the structure of the SPT layer, resulting in epitaxial strain in the magnetic film which then gives rise to an increase, or decrease, of the coercive field. This effect can be applied to thermal-assisted magnetic recording, a technology that can increase storage capacities in hard drives. Proof of concept has been achieved with a demonstration that stress associated with structural changes across the metal-insulator phase transition in VO2 and V2O3 produces a magnetoelastic anisotropy in proximity coupled ferromagnetic films (Co and Ni). The changes in coercivity are as large as 168% and occur in a very narrow temperature interval. This effect can be controlled and inverted by the thickness and the deposition temperature of the ferromagnetic films

RELATED MATERIALS

- Control of magnetism across metal to insulator transitions Appl. Phys. Lett. 102, 122404 (2013) - 03/28/2013

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,419,209	08/16/2016	2013-022

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OTHER INFORMATION

KEYWORDS

ferromagnetic, metal-insulator transition, structural phase transition, thermal-assisted magnetic recording, magnetic storage, hard drive, memory

CATEGORIZED AS

- **Materials & Chemicals**
  - Storage
  - Thin Films

RELATED CASES

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