

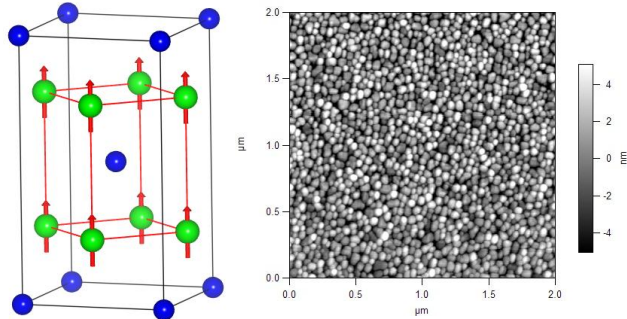


# Novel Ferromagnetic material for High Density Magnetic Recording

Available for licence

## Basic overview

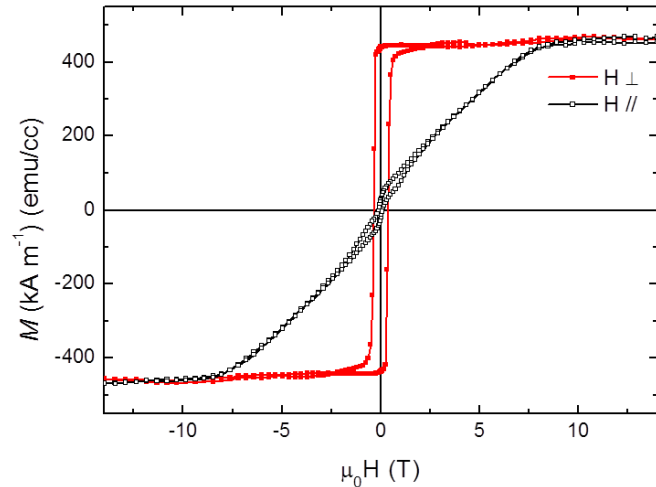
A new material  $Mn_2Ga$  has been developed to address the requirements of **high density** bit patterned perpendicular recording media in hard disk drives.  $Mn_2Ga$  has a great potential to fulfil the needs for recording densities up to **10 Tbit per square inch** with 10 year thermal stability, and can be deposited with equipment that is already available within industrial facilities. The superior magnetic anisotropy allows this new material to be used, in both conventional granular and future bit-patterned media, pushing the superparamagnetic size limit downwards. The next generation of high density magnetic recording will likely utilise high anisotropy magnetic materials patterned into nano-scale islands. Most alternative, potentially useful materials, are alloys or multilayers containing precious or rare metals.



(a) Crystal structure of  $Mn_2Ga$ . (b) Atomic force micrograph of a 10 nm thick film, grown on  $MgO[001]$ , showing the granular morphology at small thicknesses.

## Advantages

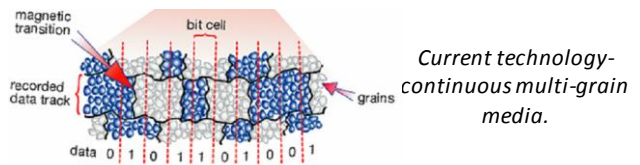
- **Cost effective:** Ga costs \$600/kg, Pt costs \$60000/kg.
- Can support **10 Tbit/inch<sup>2</sup>** with 10-year data retention, based on the observed value of uniaxial anisotropy constant of  $K_u = 2.35 \text{ MJ m}^{-3}$ .
- $Mn_2Ga$  possesses a unique combination of high magnetisation (470 kA/m (emu/cc)), high perpendicular uniaxial anisotropy ( $2.35 \text{ MJ m}^{-3}$ ) and high Curie temperature (730 K), which are essential for high density magnetic recording.
- Can be deposited by DC-magnetron sputtering at a substrate temperature of 350°C, approximately half the growth temperature of  $L1_0$ -FePd and CoPt alloys, and does not require successive annealing steps.
- Lower coercivity



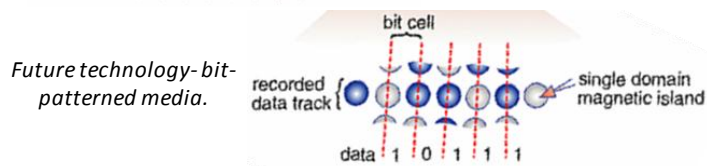
Magnetic hysteresis of an  $Mn_2Ga$  film, measured at 300 K for in-plane and perpendicular-to-plane configurations. The anisotropy field is  $\sim 10 \text{ T}$ , a clear signature of the high uniaxial anisotropy constant.

## Applications

- Quasi-continuous recording media
- Bit-patterned recording media
- Magnetic random access memory (MRAM)
- Hard bias materials (actuators, transducers, etc.)



Current technology-continuous multi-grain media.



Future technology-bit-patterned media.

## The opportunity

This new material is available for licensing.

## Technology and patent status

A US patent has been filed on this technology: US20120141837

