عناوین

۱- مواد فرومغناطیس

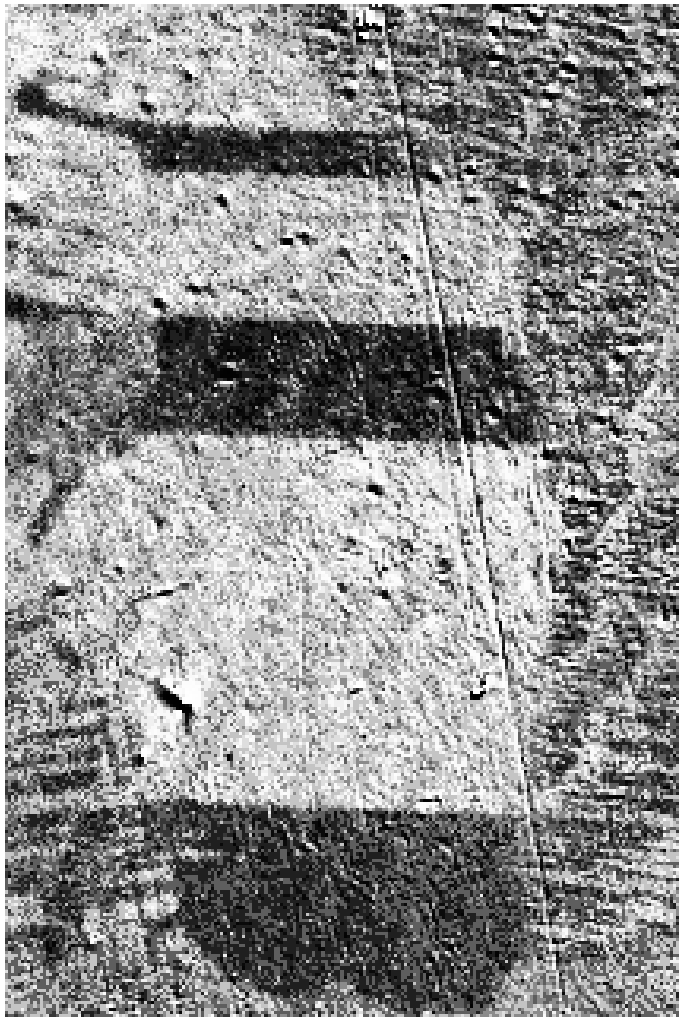
۲- مقدمه ای بر اسپینترونیک(Spintronic)

Magnetized materials مواد مغناطیسی

چگونگی آرایش حوزه های مغناطیسی در حضور میدان مغناطیسی خارجی؟

Thus, a piece of iron in its lowest energy state ("unmagnetized") generally has little or no net magnetic field. However, the magnetic domains in a material are not fixed in place; they are simply regions where the spins of the electrons have aligned spontaneously due to their magnetic fields, and thus can be altered by an external magnetic field. If a strong enough external magnetic field is applied to the material, the domain walls will move by the process of the spins of the electrons in atoms near the wall in one domain turning under the influence of the external field to face in the same direction as the electrons in the other domain, thus reorienting the domains so more of the dipoles are aligned with the external field.

The domains will remain aligned when the external field is removed, creating a magnetic field of their own extending into the space around the material, thus creating a "permanent" magnet. The domains do not go back to their original minimum energy configuration when the field is removed because the domain walls tend to become 'pinned' or 'snagged' on defects in the crystal lattice, preserving their parallel orientation. This is shown by the Barkhausen effect.



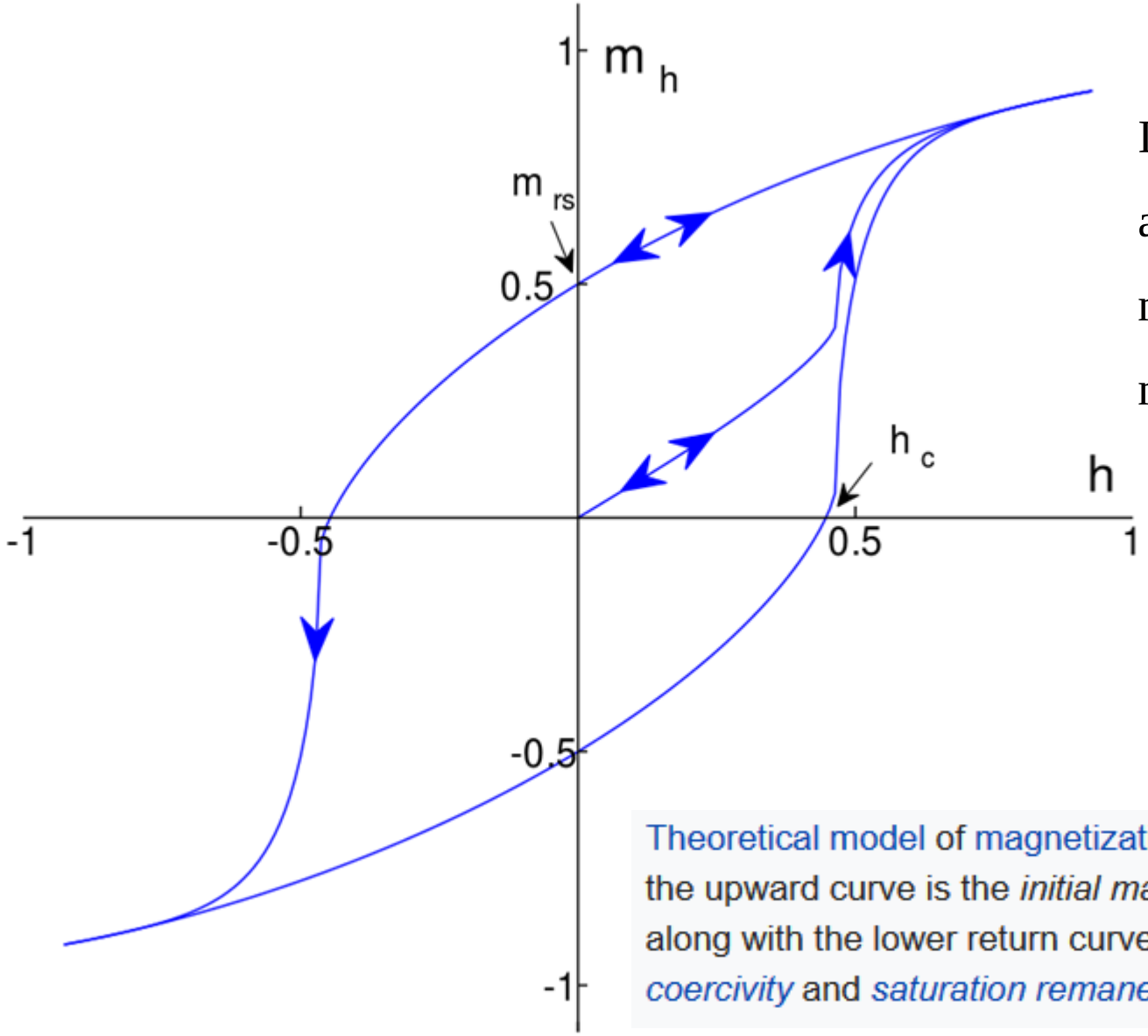
Moving domain walls in a grain of silicon steel caused by an increasing external magnetic field in the "downward" direction, observed in a Kerr microscope. White areas are domains with magnetization directed up, dark areas are domains with magnetization directed down.

This magnetization as a function of the external field is described by a hysteresis curve.

Hysteresis curve منحنی هیسترزیس(یا پسماند)

Magnetic hysteresis occurs when an external magnetic field is applied to a ferromagnet such as iron and the atomic dipoles align themselves with it. Even when the field is removed, part of the alignment will be retained: the material has become magnetized. Once magnetized, the magnet will stay magnetized indefinitely(بطور نامحدود). To demagnetize it requires heat or a magnetic field in the opposite direction. This is the effect that provides the element of memory in a hard disk drive.

Hysteresis curve



In materials science, the magnetic coercivity, is a measure of the ability of a ferromagnetic material to withstand(مقاومت) an external magnetic field without becoming demagnetized.

Theoretical model of magnetization m against magnetic field h. Starting at the origin, the upward curve is the *initial magnetization curve*. The downward curve after saturation, along with the lower return curve, form the *main loop*. The intercepts h_c and m_{rs} are the *coercivity* and *saturation remanence*.

The relationship between field strength H and magnetization M is not linear in such materials. If a magnet is demagnetized (H=M=0) and the relationship between H and M is plotted for increasing levels of field strength, M follows the initial magnetization curve. This curve increases rapidly at first and then approaches an asymptote(مجانب) called magnetic saturation. If the magnetic field is now reduced monotonically(یکنواختی), M follows a different curve. At zero field strength, the magnetization is offset(جابجا شدن) from the origin by an amount called the remanence(پسماند). If the H-M relationship is plotted for all strengths of applied magnetic field, the result is a hysteresis loop called the main loop.

درایو هارد دیسک چیست؟

A hard disk drive (HDD), hard disk, hard drive, or fixed disk, is an electromechanical data storage device that uses magnetic storage (ذخیره سازی) to store and retrieve (بازیابی) digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material. The platters are paired with magnetic heads, usually arranged on a moving actuator (فعال کننده) arm, which read and write data to the platter surfaces. HDDs are a type of non-volatile storage, retaining stored data even when powered off.

Curie temperature

As the temperature increases, thermal motion, or entropy, competes with the ferromagnetic tendency for dipoles to align.

When the temperature rises beyond a certain point, called the Curie temperature, there is a second-order phase transition and the system can no longer maintain(حفظ) a spontaneous magnetization, so its ability to be magnetized or attracted to a magnet disappears, although it still responds paramagnetically to an external field.

Below that temperature, magnetic moments become aligned with their neighbors (ferromagnetic).

INTRODUCTION TO SPINTRONICS

- Conventional electronic devices ignore the spin property and rely(تکیه) strictly(موکدا) on the transport of the electrical charge of electrons

- Adding the spin degree of freedom provides new effects, new capabilities and new functionalities

FUTURE DEMANDS

- **Moore’s Law states that the number of transistors on a silicon chip will roughly double every eighteen months**
- **By 2008, it is projected that the width of the electrodes in a microprocessor will be 45nm across**
- **As electronic devices become smaller, quantum properties of the wavelike nature of electrons are no longer negligible**
- **Spintronic devices offer the possibility of enhanced(افزایش) functionality, higher speed, and reduced power consumption(مصرف)**

ADVANTAGES OF SPIN

- **Information is stored into spin as one of two possible orientations**
- **Spin lifetime is relatively long, on the order of nanoseconds**
- **Spin currents can be manipulated(دستکاری کردن)**
- **Magnetic storage is nonvolatile**
- **Binary spin polarization offers the possibility of applications as qubits in quantum computers**