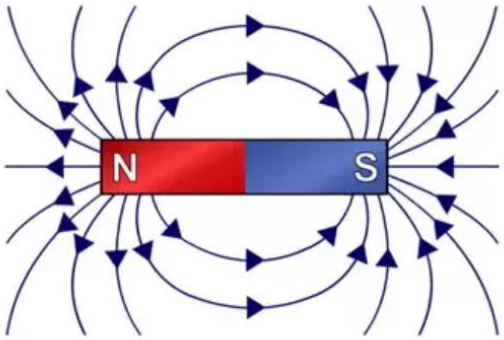
MAGNETISM AND MAGNETS – MAIN PRINCIPLES

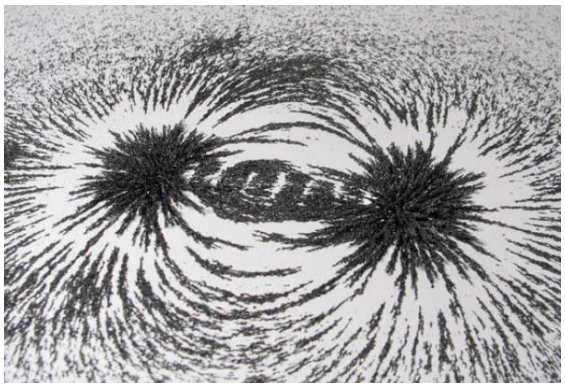
MAGNETISM

1] a physical phenomenon produced by the motion of electric charge, resulting in attractive and repulsive forces between objects. The force of magnetism, or magnetic field, is much stronger at the magnet poles than around the equator.

2] the ability to attract and charm people. (☺ ..for another presentation)

MAGNETIC FIELD LINES AND POLES

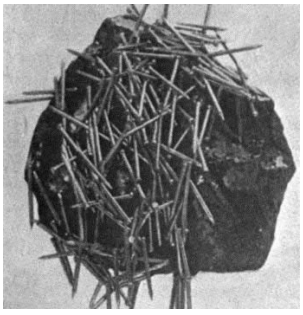




Magnetic field lines show the direction of the magnetic field between poles, the arrow indicates which direction. Outside the magnet: from north to south pole. Inside magnet: from south to north pole.

The amount of field lines tell you about density - the strength of the field at that point. So magnetic field at the poles is bigger than at the sides of the magnet. There are various In commercial magnetic appliances the engineers combine various mass and shapes of the commercial magnets.

MAGNETIC ORES / ARTIFICIAL MAGNETIC MATERIALS – commercial magnets



lodestone (natural magnetic ore) / ferric magnet

A] ELECTROMAGNETS

Electromagnets produce magnetic fields only when electricity travels through their wire coils. Electromagnets can reach huge performance but they are not ecologic, they use to heat up very fast and it takes a lot of energy to use them.

B] TEMPORARY MAGNETS

Temporary or soft magnets produce magnetic fields while in the presence of a magnetic field and for a short while after exiting the field.

C] PERMANENT MAGNETS

Permanent or hard magnets create their own magnetic field all the time.

C.1] PLASTIC MAGNETS, flexible and moldable, however, some work only at extremely low temperatures, and others pick up only very lightweight materials.

C.2] CERAMIC MAGNETS, like the ones used in refrigerator magnets, contain iron oxide in a ceramic composite. Most ceramic magnets, sometimes known as ferric magnets, aren't particularly strong.

ALNICO MAGNETS are made from aluminum, nickel and cobalt. They're stronger than ceramic magnets, but not as strong as the ones that incorporate a class of elements known as rare-earth metals.

C.3] RARE EARTH MAGNETS / the strongest commercial magnets

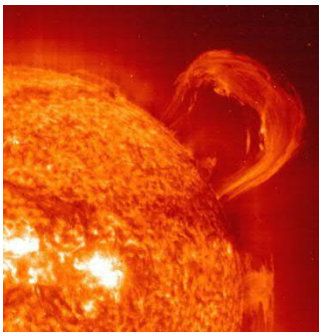
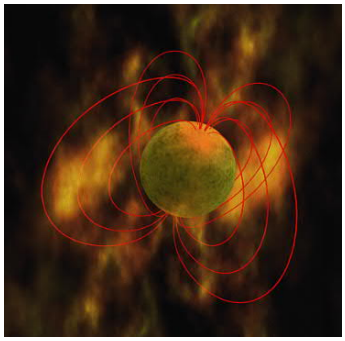
SAMARIUM COBALT MAGNETS combine cobalt with the rare-earth element samarium.

NEODYMIUM MAGNETS contain iron, boron and the rare-earth element neodymium. Magnetic field of ceramic magnets is in general longer than of the neodymium magnets – in other words neodymium field declines MUCH faster than ceramic field in SHORT distance from the magnet. The magnetic field of ferrite magnets can be damaged if it comes into contact with a stronger field. Therefore do not attach neodymium magnets to ferrite magnets.

FERROMAGNETIC METALS

The common ferromagnetic metals include iron, nickel, cobalt, gadolinium, dysprosium and alloys such as (stainless) steel that also contain specific ferromagnetic metals such as iron or nickel.

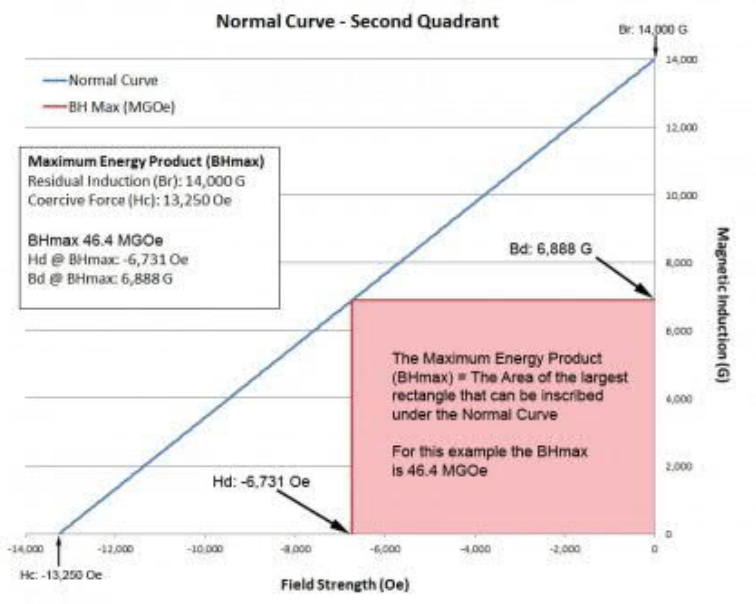
MAGNETIC PROPERTIES / STRENGTH OF THE FIELD


Sun and earth are both huge magnets. The earth's magnetic field is 0.5 Gauss and a refrigerator magnet is 10 Gauss. Considering only these numbers one would think that a refrigerator magnet is more powerful than the earth. This of course is incorrect, the earth, due to its immense size is immeasurably more powerful.

Density of magnetic energy (BH)

Density of magnetic energy BHmax, about 10 times higher than of common ceramic magnets. Generally, a magnet with a higher BHmax will be stronger than a magnet with a lower BHmax, but that still does not allow us to predict performance relative to magnetic field density or flux generation.



Measurable properties of magnetic materials (Residual Induction x Coercive Force)

Magnetic Material	Maximum Energy Product BH (max)	Residual Induction Br	Coercive Force Hc
	MGO	Gauss	Oersteds
Ceramic - Grade 8	3.5	3850	2950

Magnetic Material	Br (T)	Hci (kA/m)	BHmax (MJ/m3)
Neodymium, sintered	1.0–1.4	750–2000	20–44
Sr-ferrite, sintered	0.2–0.78	100–300	10–40

NOTE: In our MSA magnets we use Neodymium alloy of grade N35 (35 MGO).