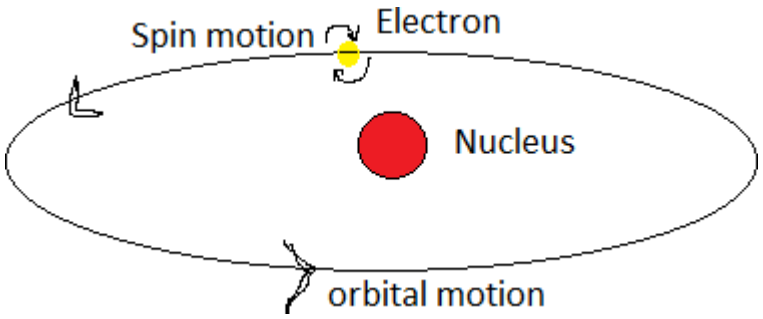
Unit IV-Magnetism
Introduction to Magnetic Materilas

All substances show some kind of magnetic behaviour. After all, they are made up of charged particles: electrons and protons. It is the way in which electron clouds arrange themselves in atoms and how groups of these atoms behave that determines the magnetic properties of the material. The atom (or group of atoms) in effect becomes a magnetic dipole or a mini bar magnet that can align according to the magnetic field applied. The net effect of all these dipoles determines the magnetic properties of the magnetic materials.

Electricity is the movement of electrons, whether in a wire or in an atom, so each atom represents a tiny permanent magnet in its own right. The circulating electron produces its own orbital magnetic moment, and there is also a spin magnetic moment because the electron itself spins, like the earth, on its own axis.



In most materials these magnetic moments, measured in Bohr magnetons (μB), cancel each other out with each electronic magnet negating the field produced by another. In certain magnetic materials the magnetic moments of a large proportion of the electrons align, producing a unified magnetic field. The field produced in the material (or by an electromagnet) has a direction of flow, and any magnet will experience a force trying to align it with an externally applied field, just like a compass needle. These forces are used to drive electric motors, produce sounds in a speaker system, control the voice coil in a CD player, and so on. The interactions between magnetism and electricity are therefore an essential aspect of many devices we use every day.

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MAGNETIC MATERIALS - TERMS

Magnetic Susceptibility: Ratio of intensity of magnetisation produced in the sample to the magnetic field intensity which produces magnetization. It has no units. $\chi = M/M$

Magnetization: The process of converting a non magnetic material to a magnetic material.

Intensity of magnetization: It is magnetic moment per unit volume. • Relative permeability: The ratio of flux density produced in a material to the flux density produced in vacuum by the same magnetising force.

Magnetic flux (Φ): The total no: of magnetic lines of force in a magnetic field (unit- Weber)

Magnetic flux density (B): Magnetic flux per unit area at right angles to the direction of flux. (Wb/M^2)

Magnetic field intensity (H): Magneto motive force per unit length of the magnetic circuit. It is also called magnetic field strength or magnetizing force. (A-turns/m)

Permeability (μ): The ability of a material to conduct magnetic flux through it. (H/m)