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Article Review On Magnetic Materials

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Abstract: : It is obvious that magnetic effects of materials depend on the existence of odd number of `electrons in their orbits. The materials exist in the odd electrons of orbits, their atoms show their effects in materials in spinal movement as magnetic, Furthermore ,the materials that have magnetic effects are divided into paramagnetic, Ferro magnetic and anti-Ferro magnetic, material which have pair electrons in their orbits don't have magnetics properties called dia magnetic.

Keywords: Ferro magnet, Para magnet , anti-Ferro magnet , dia magnet

INTRODUCTION:

1.WHAT IS MAGNETIC MATERIAL

The material through which magnetic lines passes and attract it is called as magnetic material.

The history of magnetsm dates back to earlier than 600 b.c., but it is only in the twenteth century that scientsts have begun to understand it, and develop technologies based on this understanding. Magnetsm was most probably frst observed in a form of the mineral magnette called lodestone, which consists of iron oxide- a chemical compound of iron and oxygen. The ancient Greeks were the frst known to have used this mineral, which they called a magnet because of its ability to atract other pieces of the same material and iron.

The objective of these study is to replace mechanical gears which are noisy, require frequent maintenance and lubrication, and suffer from friction losses. The magnetic gear is contactless and quiet in operation, and it requires no lubrication. In addition, it slips when overloaded whereas the mechanical gear may break down when overloaded. The magnetic gear transmission is used for mechanical gear transmission with help of the magnet and electrical motor. This is transducer electrical energy convert to the mechanical energy. The ability to hermetically separate two areas when continuing to transmit mechanical power from one to the other makes these couplings ideal for applications where prevention of cross contamination is essential .For instance: hydraulic sectors, dosing systems, compressors, sterilizers, industrial ovens, biotechnology, subsea equipment, pharmaceutical industry, chemical industry, food industry, generators, mixers. A magnetic coupler transmits a force without any actual physical contact. Since magnetic forces attract and repel, and this force performs work, the action can be linear or rotary. A simple magnetic coupler has a follower and a driver. The driver is connected to a motor, while the follower reacts to the driver's motion, and this results in the transmission of mechanical energy without contact. To understand a magnetic coupler, it is helpful to understand magnets. A magnet produces a magnetic field or force. This force acts on ferromagnetic materials and pulls them together or pushes them apart. Ferromagnetic materials include iron, cobalt, nickel, and certain alloys. The overall strength of a magnet is measured by what is termed its magnetic moment, or by the magnetic flux that is produced.

1.CHARACTERISTICS OF MAGNETIC MATERIALS:

- They have high permeability.
- Maximum magnetic field strength.
- The resistivity is relatively high.
- They produce strong or weak magnetic field.
- The poles of all magnets exist in pairs.

TYPES OF MAGNETIC MATERIALS:

I. Diamagnetic material
II. Paramagnetic material
III. Ferromagnetic material
IV. Anti-Ferromagnetic material

Diamagnetic Material:

This type of material is removed when exposed to an external magnetic field and tends to settle if it is perpendicular to the magnetic field. The lines of magnetic force move away from each other as they pass through. As a result, the density of the magnetic field decreases and therefore the magnetic field decreases.

The presence of diamagnetic properties depends on the presence of electrons formed in the orbitals. In this case the substance has no magnetic properties. If under the influence of an external field, the order of the electrons formed in the orbitals changes. Acts in the opposite direction. Therefore, the magnetism of the outer field is reduced by gases that do not have unique electrons, such as noble gases, hydrogen, fluorine, chlorine, nitrogen, sulfur dioxide, carbon monoxide, carbon dioxide molecules (and the same material as liquids and solids). Silicon, phosphorus, sulfur, arsenic, selenium, metals such as mercury, liquid or solid zinc, red gold, lead in solid state are considered ordinary dima magnetic materials. Increases with increasing such as beryllium, bore, diamond, silver, iodine, (solid) or decreases with increasing temperature such as **graphite, copper, chromium.**

APPLICATIONS :

- Magnetic resonance imaging(MRI)
- Guns
- Levitation
- Microprocessors and hard drives
- Superconductor

PARAMAGNETIC MATERIALS:

One of the characteristics of this type of material is that every time it is in a magnetic field, it is pulled towards that field and parallel to the lines of magnetic force, hence the line of magnetic force passing through itself. Brings them closer to each other and increase the density of the magnetic field. As a result, the magnetic field in them is much higher than in an empty space. Out of the field loses its magnetic properties

Paramagnetc materials have unpaired electrons, leading to a weak atracton to a magnetc feld. The unpaired electrons tend to align their magnetc moments with the external feld, but thermal moton hinders full alignment

Examples: **Aluminium,Iron oxide,Tungsten,Sodium,Oxygen**

APPLICATIONS:

- Cell labelling
- Magnetic fluids
- Oxygen analyser
- Meta detector
- Signal transmission
- Data storage
- Electronics

FERROMAGNETIC MATERIALS:

Ferromagnetc materials exhibit strong and permanent magnetzaton even in the absence of an external magnetc feld. This behavior arises from the alignment of atomic magnetc moments due to a phenomenon called exchange interacton.

Examples include iron, nickel, and cobalt.

Ferromagnetic materials are materials that have properties similar to the magnetic properties of iron and the magnetism of them is higher than that of paramagnetic materials in karate, so they are of special value in industry and technology. Specimens are rare, such as natural iron magnetic oxide or magnetite (Fe3O4), iron family metals (iron, cobalt, and nickel) and some alloys. Dispersium and gadolinium differ in their ferromagnetic properties from paramagnets in that their magnetic properties remain outside the magnetic field as opposed to paramagnets and decrease dramatically with increasing temperature. Also a ferromagnetic property is a group or auxiliary phenomenon as opposed to a paramagnet belonging to a single particle (atoms or molecules) in which the particles form small groups or microscopic particles of crystal in each of which are oriented towards electrons and The vector of each component is like a small magnet, the spin of electrons outside the magnetic field, and consequently the magnetic axes are irregular in relation to these spheres in such a way that their effects are somewhat neutral.

APPLICATION OF FERROMAGNETIC MATERIAL:

- Transformer
- Magnetic strips
- Devices
- Artificial intelligence

ANTI-FERROMAGNETIC MATERIAL:

In antferromagnetc materials, neighboring magnetc moments align in opposite directons, resultng in a net magnetc moment of zero. The alignment is such that the magnetc forces cancel each other out.

There are different areas of crystals of this type of material. Not only are the electrons in each sphere of the crystal with non-parallel spins, but the orientation of their spines varies from one sphere to another in such a way that the product in each sphere is different. Zero does not show any noticeable properties at normal temperature or low temperature. Another type of material is free magnetic objects, Orbitals have odd electrons. Why aren't the odd electrons in the adjacent crystals equal? Because the odd electrons of adjacent particles are not the same, so the spheres do not completely neutralize each other. It has magnetic properties such as NiFe2O4, MnCr2O4, MnCr2S4.It has low electrical conductivity and thermal losses are many times less than that of a ferromagnetic material.

Examples :Iron,Nickel,Cobalt

APPLICATIONS:

- **Magnetic Recording**
- **Spintronics**
- **Magnetic sensor**
- **Memory device**
- **Neutron scattering**

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