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Magnetic Property of Solids

The magnetic properties of a solid are the result of the magnetic property of the atoms or ions of these solids.

How magnetic behaviour?

Magnetic behaviour of the electrons of an atom is due to the movement patterns, two types of movements.

- Electrons revolve around the nucleus of the atom
- Electrons also spin on their own axis, spins in opposite sides are labelled with + and – signs

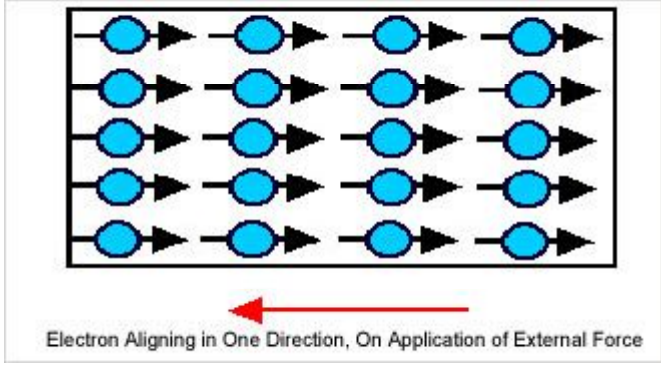
(These constant motions make an electric field around the electrons, almost like a loop of current which lends it its magnetic property)

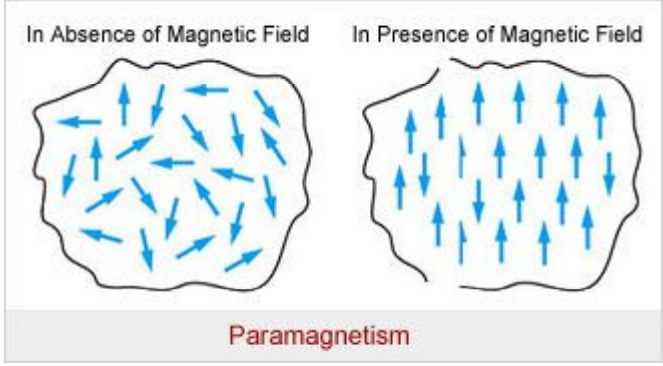
Types of materials

1. **Paramagnetic**
2. **Diamagnetic**
3. **Ferromagnetic**
4. **Antiferromagnetic**
5. **Ferrimagnetic**

Paramagnetic

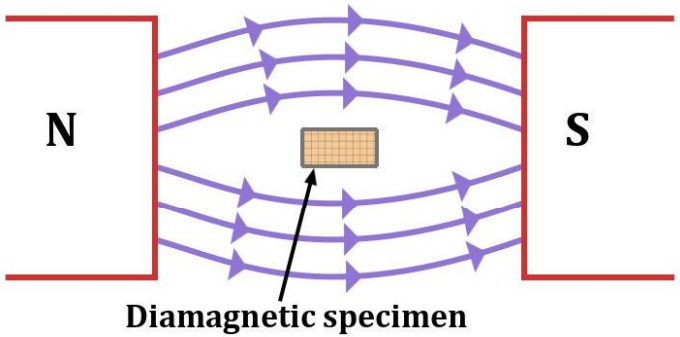
- weakly magnetized in an external magnetic field.
- The direction is the same direction of the magnetic field.
- paramagnetic substances are not permanent magnets.
- at least one pair of unpaired electrons in its orbit
- examples are O2, Cu2 etc.
- find a variety of applications in electronics.





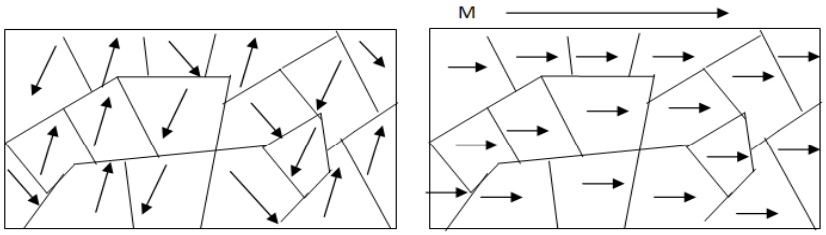
Diamagnetic

- Substances are magnetized in an external magnetic field
- Diamagnetic solids are repelled in the field
- All electrons in their last shell are paired
- There are no valence electrons.
- Magnetic moment of their atoms is nearly zero
- Examples are substances like Sodium Chloride, Benzene etc.
- Being such bad conductors, we use them as insulators



Ferromagnetic

- strongly magnetized when place them in an external magnetic field.
- very strong attraction forces
- even when the external magnetic fields are removed the solids will retain their magnetic properties (permanent magnets)
- They have “domains’ which is a special grouping of metal ions.
- Each domain is similar to a small magnet.
- In an electromagnetic field, these domains rearrange themselves and align themselves with the magnetic field.
- In a non-magnetized metal, these domains are randomly arranged and it cancels out their magnetic properties.
- Examples: Cobalt, Nickel, Chromium Oxide etc.

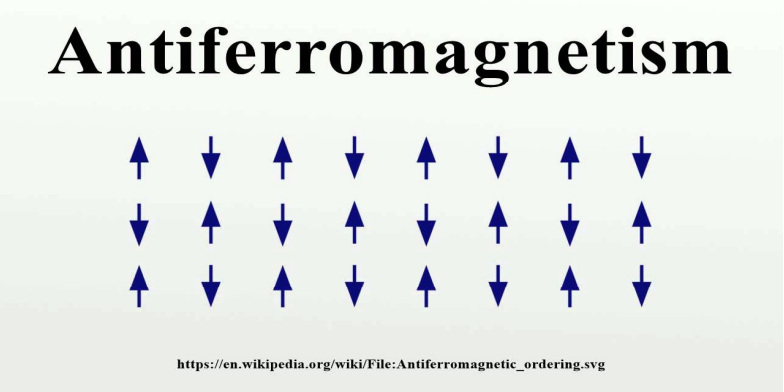


A. Random domain orientation B. After magnetization

Figure 1

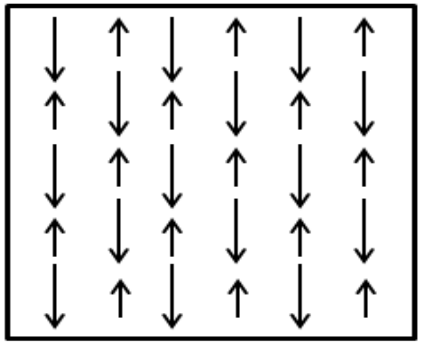
Antiferromagnetic

- They have “domains’ which is a special grouping of metal ions.
- The domain structures of the solid are very similar to those of ferromagnetic solids.
- But here the domains are oppositely oriented.
- They cancel out each other’s magnetism.



Ferrimagnetic

- These substances occur when magnetic moments are aligned in both directions (parallel as well as anti-parallel) but in unequal numbers.
- These are weakly attracted to magnetic fields.
- on heating, these substances will lose their ferrimagnetism.
- Examples are magnetite and ferrites of Zinc and Magnesium.



Solved Question

- Q: The temperature at which the domain structure gets destroyed and ferromagnetic substance is converted into the paramagnetic substance are called as
  a) critical temperature
  b) saturation temperature
  c) curie temperature
  d) Kraft temperature

Answer

- Ans: The correct option is “C”. Curie temperature or Curie point is the temperature at which certain materials lose their permanent magnetic properties, to be replaced by induced magnetism. The Curie temperature is named after Pierre Curie, who showed that magnetism was lost at a critical temperature. And ferromagnetic substances get converted into paramagnetic substances.

Thank you