

Magnetization

Magnetization

Induced magnetization, J_i . When a material is exposed to a magnetic field H , it acquires an induced magnetization. These are related through the magnetic susceptibility, χ .

$$J_i = \chi H.$$

Factors affecting the magnetic susceptibility include:

- The electron spin.
- Number of electrons within the outer shell - pair or odd?

Remnant magnetization, J_r . The remnant of past magnetic field that have acted on the material.

Magnetization

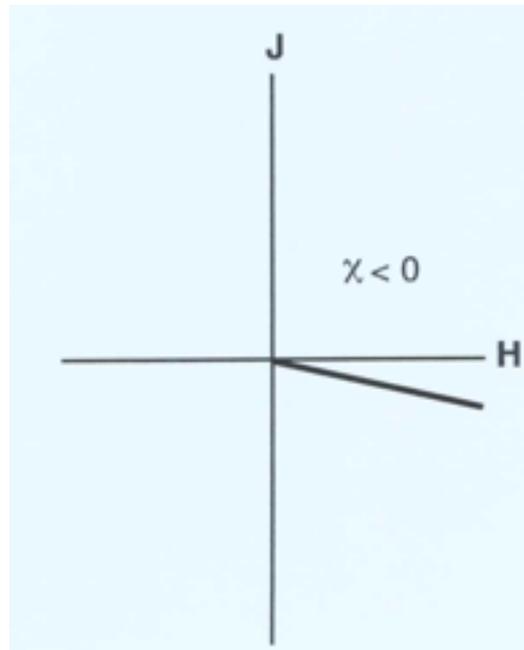
Three types of magnetic materials:

- Paramagnetic
- Diamagnetic
- Ferromagnetic

Magnetization

Diamagnetic substance:

- Acquisition of SMALL induced magnetization OPPOSITE to the applied field.
- The magnetization depends linearly on the applied field and reduces to zero on removal of the field.

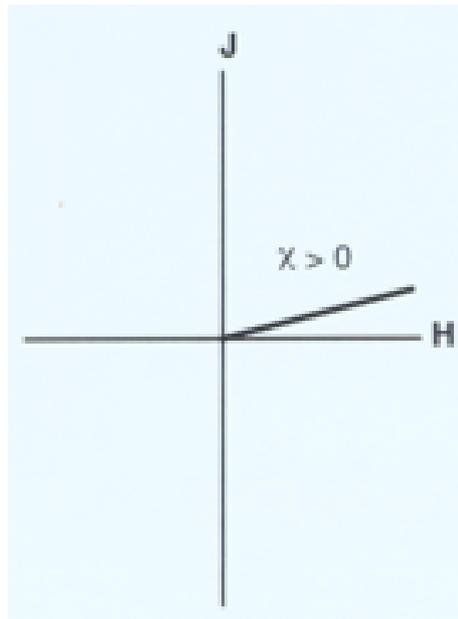


Magnetization

Paramagnetic substance:

- The susceptibilities of paramagnetic substances are SMALL and POSITIVE.
- The magnetization depends linearly on the applied field and reduces to zero on removal of the field

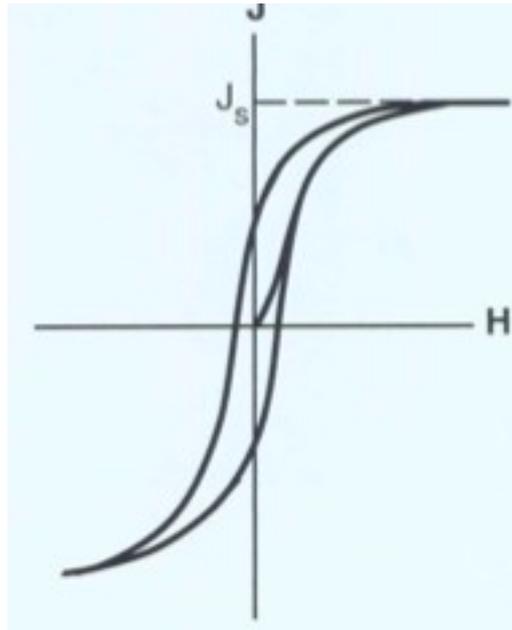
Can only be observed at relatively low temperatures. The temperature above which paramagnetism is no longer observed is called the **Curie Temperature**.



Magnetization

Ferromagnetic substance:

- The path of the magnetization as a function of the applied field is non-linear and is called **hysteresis** loop.
- Magnetization that can be orders of magnitude larger than for the paramagnetic solids.



Magnetization

Ferromagnetic substance (continue):

- Upon removal of the magnetizing field, magnetization does not return to zero but retains a record of the applied field.
- Like paramagnetism, ferromagnetism is observed only at temperatures below the **Curie temperature**.

