**Diamagnets**

These are materials whose induced current gives rise to a magnetic field which opposes the applied magnetic field H. Thus magnetization, M will be in the opposite direction to H and





therefore H/M is negative, and hence susceptibility $\chi$ is negative. Example is Bismuth with $\chi$ = -0.000015.

**Paramagnets**

In these materials that atoms are always in thermal motion which causes the magnetic moments to be oriented purely at random and therefore no resultant magnetization. But if a field is applied, each atomic moment will try to align in the direction of the field even though thermal motion will prevent complete alignment. In this case there will be weak magnetization in the direction of the applied field. Hence susceptibility $\chi$ of a paramagnet substance is very small and positive. Example is Platinum with $\chi$ = +0.0001.

Ferromagnets

In a ferromagnetic material the magnetization due to orbital electrons is in the same direction as the applied field. Thus a ferromagnetic material aligns itself with an applied field. Hence it has high positive susceptibility$\chi$. Ferromagnetic materials are further grouped into two:

Soft Magnetic Materials

These magnetise easily and demagnetise when the applied field is removed. Example is Iron used in transformers.

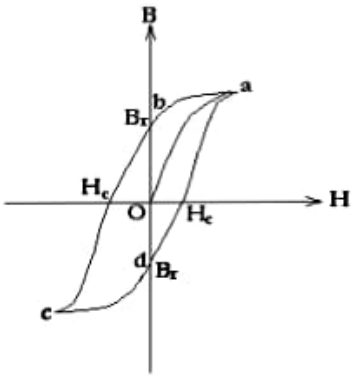
Hard Magnetic Materials

These are hard to magnetise but retain their magnetism when the applied field is removed. Example is Steel used in making permanent magnets.



## 1.16 Hysteresis Loop

The variation of *B* with applied field *H* when magnetic material specimen is taken through a complete circle is as shown below




oa→ the field *B* increases with increase in applied field *H*.

ab→ the applied field *H* is reduced to zero and the field *B* follows the path ab.

bc→ the applied field *H* is increased in the opposite direction.

The same process is done with cd and da.