4.4. Hysteresis

When a magnetic material is taken through a cycle of magnetization, the variation of (B) with respect to (H) can be represented by a closed curve. In other words, the lagging of magnetization behind the magnetizing field is known as hysteresis curve.

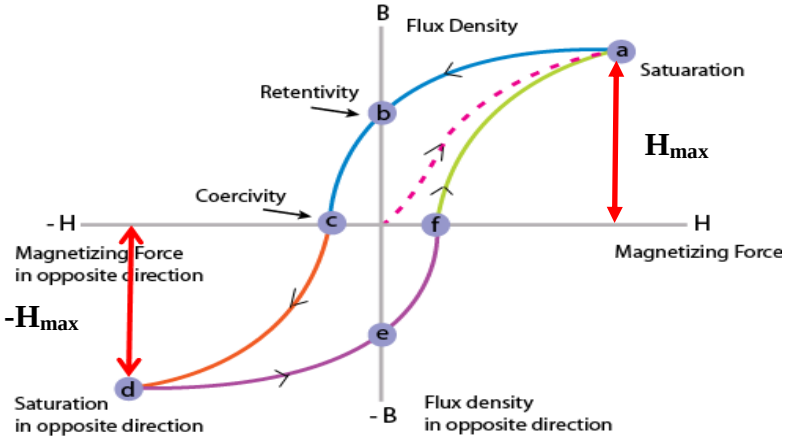


Fig:4.4.1 Hysteresis

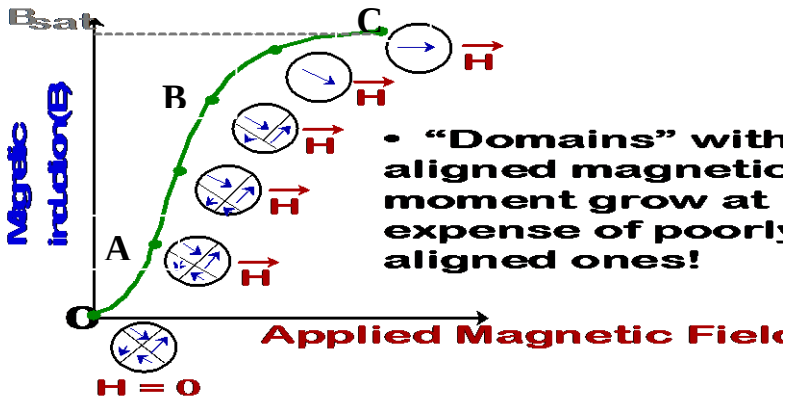
Explanation

If a magnetizing field (*H*) is applied to a ferromagnetic material and if *H* is increased H_{max} The material acquires the magnetism. So the magnetic induction also increases, represented by '*oa*' in the above figure.

Now the magnetic field is decreased from $H_{max}$to zero, the magnetic induction will not fall rapidly to zero. But it fall '*b*' rather than zero. This shows that even when the applied field is zero (or) removed, the material still acquires some magnetic induction (*ob*) which is so called **residual magnetism(or) Retentivity**.

Now, to remove this residual magnetism, the magnetic field strength is reversed and increased to $-H_{max}$represented as '*oc'* so called **coercivity**. Hence, we get the curve '*bcd*'. Then the reverse field (-*H*) is reduced to zero and the corresponding curve 'de' is obtained and further increasing *H* to H_{max} the curve '*efa*' is obtained.

4.4.2 Explanation of Hysteresis Curve on The Basis of Domain Theory



When a field is applied, for small *H*, the domain walls are displaced and gives rise to small value of magnetization. [OA in the graph]. ***Now, the field is removed, the domains return to its original state known as reversible domains.***

When the field is increases, a large number of domains contribute to the magnetization and *I* increases rapidly with *H*. ***Now, when the field is removed the domain boundaries do not come back to the original position due to the domain wall movement to a very large distance (AB in the graph). These domains are called irreversible domains.***

Now if the field is further increased, domains start rotating along the field direction and anisotropic energy is stored and it is represented as BC in the graph. Thus the specimen is said to attain maximum magnetization at this position even after the removal of the field is known as Retentivity. This Retentivity can be destroyed by applying a high reverse magnetic field called coercivity.

Thus the reversible and irreversible domain wall movements give rise to hysteresis in the Ferromagnetic materials.