Magnetic Intensity (H): - MyRank

https://blog.myrank.co.in/magnetic-intensity-h/

The ability of a magnetic field to magnetize a material medium is called its magnetic intensity H. Its magnitude is measured by the number of ampere-turns flowing round unit length of a solenoid, required to produce that magnetic field.

Let the field due to a solenoid of n turns per meter length be H = ni, where i is the current and n = N/l, N is the total number of turns and l the length of the solenoid. H does not depend upon the nature of the medium. It is a vector and is directed along the axis of the solenoid.

S.I. unit of H is ampere-turns per meter (Am^{-1}). Lines of force representing magnetic intensity are called lines of magnetic intensity.

Intensity of Magnetisation (M):

When a material medium is placed in a magnetic field, it gets magnetized. The magnetic moment per unit volume of the material is called the intensity of magnetization M (or simply magnetization).

M=Magnetic momentVolume M = M a g n e t i c m o m e n t V o l u m e

S.I. unit of magnetization is (Am^{-1}). Lines representing intensity of magnetisation are called lines of magnetisation. For a uniformly magnetised material, each dipole will point in the same direction and M will be constant throughout.

Magnetic Induction (B):

When a magnetic material is magnetized by placing it in a magnetic field, the resultant field inside the material is the sum of the field due to the magnetization of the material and the original magnetizing field. This resultant field is called magnetic induction or magnetic flux density B.

S.I. unit of B is weber/m^2 or tesla (T).

Lines of force representing B are called lines of induction.

Relation between B and H:

For para and diamagnetic substances the B – H graph is a straight line.

Relation Connecting M, B and H:

The resultant magnetic field inside a material due to a magnetizing force is the sum of flux density in vacuum produced by the same magnetic intensity and the flux density due to the magnetization of the medium. $B = \mu_o H + \mu_o M$ Or $H = (B/\mu_o) – M$.

Susceptibility ('I'$_M$):

The ease with which a specimen of a magnetic material can be magnetized is called its magnetic susceptibility and is equal to the ratio of intensity of magnetization M to the magnetic intensity H, i.e., ‘I’$_M$ = M/H.

Premeability:

The degree ω to which a magnetic field can penetrate or permeate a given medium is called its permeability and is equal to the ratio of the magnetic induction B to the magnetic intensity H i.e., μ = B/H.

Relative Permeability (μ_r):

It is defined as the ratio of the magnetic permeability of a substance (μ) to the permeability of free space.

$\mu_r = \mu/\mu_o$

μ_o = 1 for vacuum. It has no dimension.

Relation between Susceptibility and Permeability:

$B = \mu_o H + \mu_o M$

Dividing throughout by H,

$B/H = \mu_o + \mu_o M/H$, $\mu = \mu_o + \mu_o \Psi_m$

$\mu/\mu_o = 1 + \Psi_m$ the relative permeability $\mu_r = \mu/\mu_o = 1 + \Psi_m$

$\mu_r = 1 + \Psi_m$