Chapter no.19

Thermal properties!

Q. Heat Capacity:-

Energy required to increase one unit temperature of a one mole of a material is called as heat capacity.

at const vol — at const Pressure

$Cp > Cv$

I — $C = \frac{dQ}{dT}$ → energy → temp

J/molK

$Cp = \frac{5}{2}R$

Q. Comparison Cp for different materials.

$Cv = \frac{3}{2}R$

$Cp = Cv + R$ — II

The Cp increases from

metals → ceramics → polymer (highest)

(lowest).

Q. Why Cp is significantly larger for polymers?

Polymers have high Cp.

(i) Numerous vibrational rotational & translation modes due to which they have more ability to store heat energy.

(ii) Intermolecular forces like H-bonding & vander waal forces

(iii) Amorphous / Semi crystaline nature.

(iv) Lower thermal conductivity.

Q. Thermal Expansion.

Thermal expansion increases from ceramics → metals → polymers (highest).

III — $\frac{L_f - L_i}{L_i} = \alpha (T_f - T_i)$

Q. Why liquids have higher heat capacity than than solids?

Liquids have a more/greater degree of freedom contributing to their having greater entrophy than solids.
Greater degree of freedom means greater modes of storing heat and thus more heat capacity.

Q. Why α (thermal coefficient) $\frac{1}{\alpha}$ (inversely prop) to the bond energy.

Increasing bond energy means more strength required to stretch or break a bond $\therefore$ The thermal coefficient of expansion decreases.

Q. Thermal conductivity.

$$q = -k \frac{dT}{dx}$$

heat flux ← q; k → thermal conductivity; $\frac{dT}{dx}$ → temperature gradient.

IV

polymers → Ceramics → metals (highest)

polymers	Ceramics	metals
vibration of chain molecules	vibration of atoms	vibration of atoms & e^-s

Q. Difference b/w carbon steel & stainless steel.

C-steel	stainless steel
low conc. of alloying element.	greater conc. of alloying element
harder and more tensile strength	not hard.
not resistant to corrossion.	resistant to corrosion

Magnetic Moment :- "The rot. force experienced by a magnet when place in a magnetic field ⊥ magnetic axis."

↓

e's motion can produce magnetism

→ around the nucleus

→ around the axis

Anti-Ferromagnetism.

alignment of individual atoms such that they cancel the effect and no magnetic moment retains

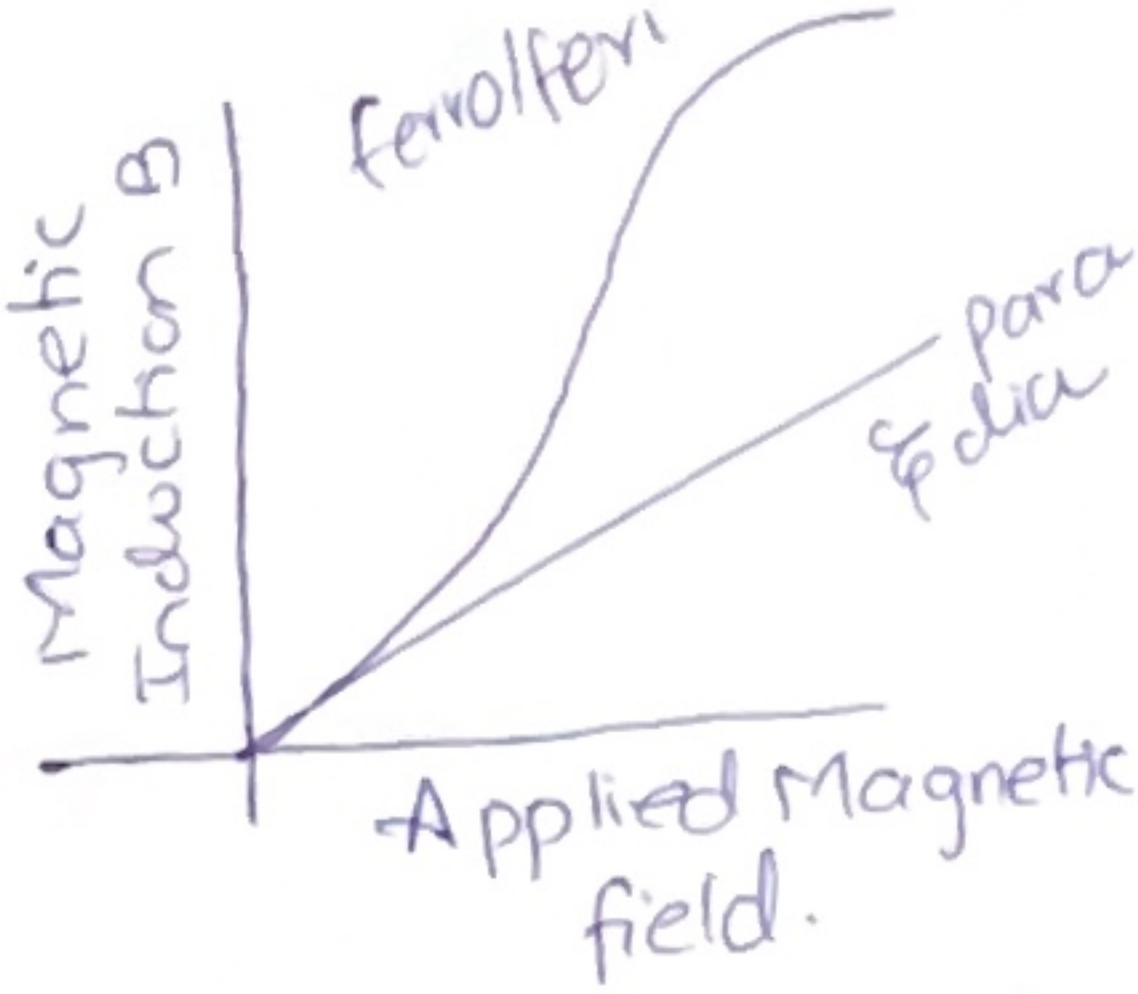
Ferrimagnetism.

opposite alignment of individual atoms without the cancelling effect.

Q. Difference b/w para - dia & ferromagnetic material.

DOMAINS & HYRSTESIS.

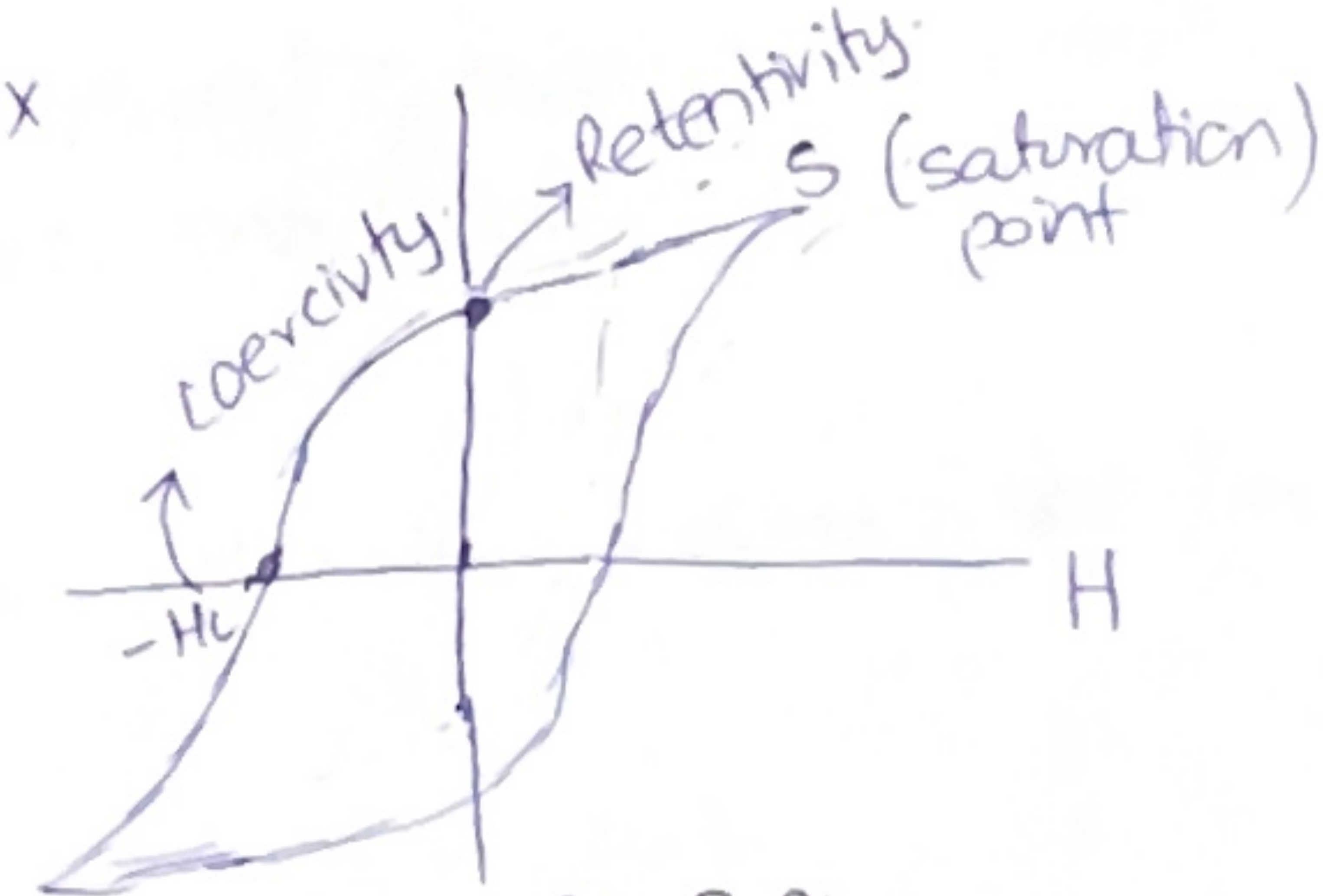
as the applied magnetic field increases the magnetic domains change size and shape by domain boundaries.



Remanence :- Residual Magnetic flux

Rehtentivity after reversal

Coercivity : negativity of H applied to bring Residual B to 0.



HARD MATERIALS

(i) Greater area of hysterisis loop or large coercivity

(ii) used for permanent magnets
↳ adds particle to inhibit domain wall motion.

(iii) tungsten steel.

SOFT MATERIALS

Viceversa

(ii) used in electric motor because they minimize energy loss, ② AC electrical applications

(iii) Iron → 99.95%