B-H Magnetization Curve

- The *B-H* magnetization curve shows how much flux density *B* results from increasing field intensity *H*.
- **Saturation** is the effect of little change in flux density when the field intensity increases.

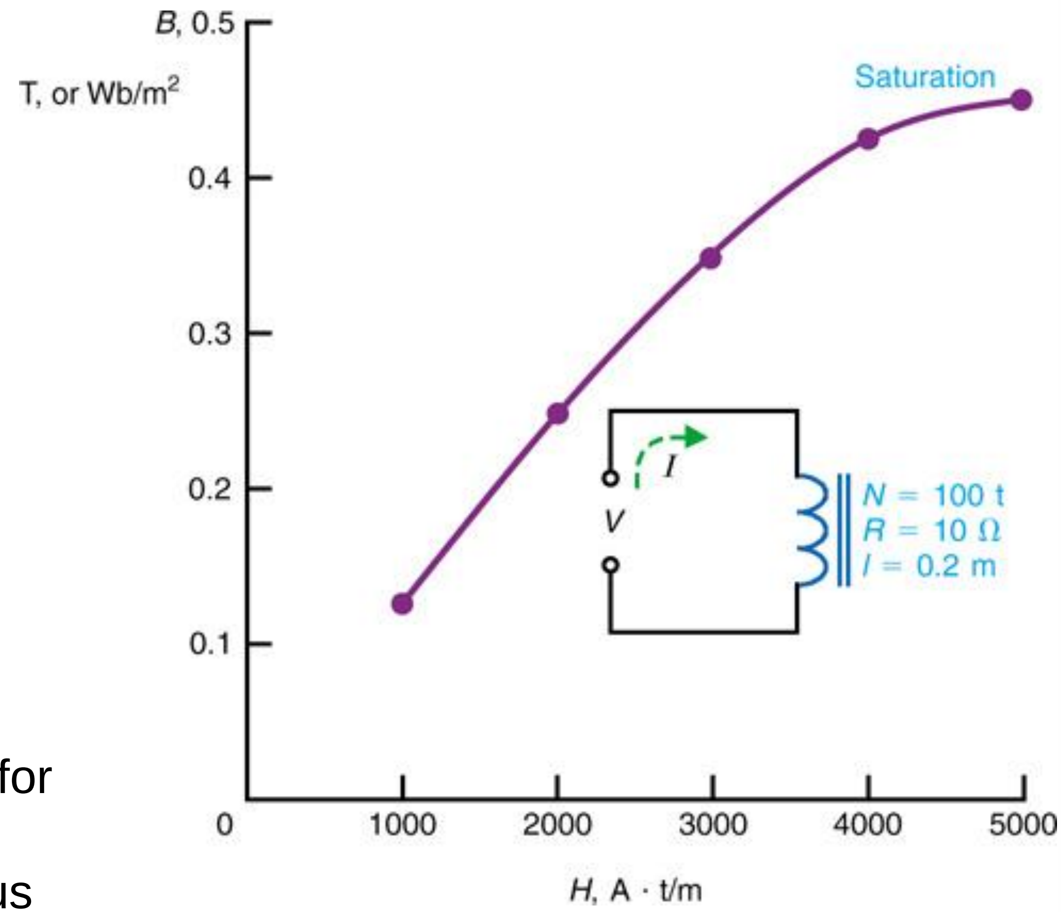

Fig. 14-3: *B-H* magnetization curve for soft iron. No values are shown near zero, where μ may vary with previous magnetization.

Magnetic Hysteresis

- **Hysteresis** refers to a situation where the magnetic flux lags the increases or decreases in magnetizing force.
- **Hysteresis loss** is energy wasted in the form of heat when alternating current reverses rapidly and molecular dipoles lag the magnetizing force.
- For steel and other hard magnetic materials, **hysteresis losses** are much higher than in soft magnetic materials like iron.

Magnetic Hysteresis

- Hysteresis Loop
  - B_R is due to **retentivity,** which is the flux density remaining after the magnetizing force is reduced to zero.
  - Note that *H* = 0 but *B* > 0.
  - H_C is the coercive force (needed to make *B* = 0)

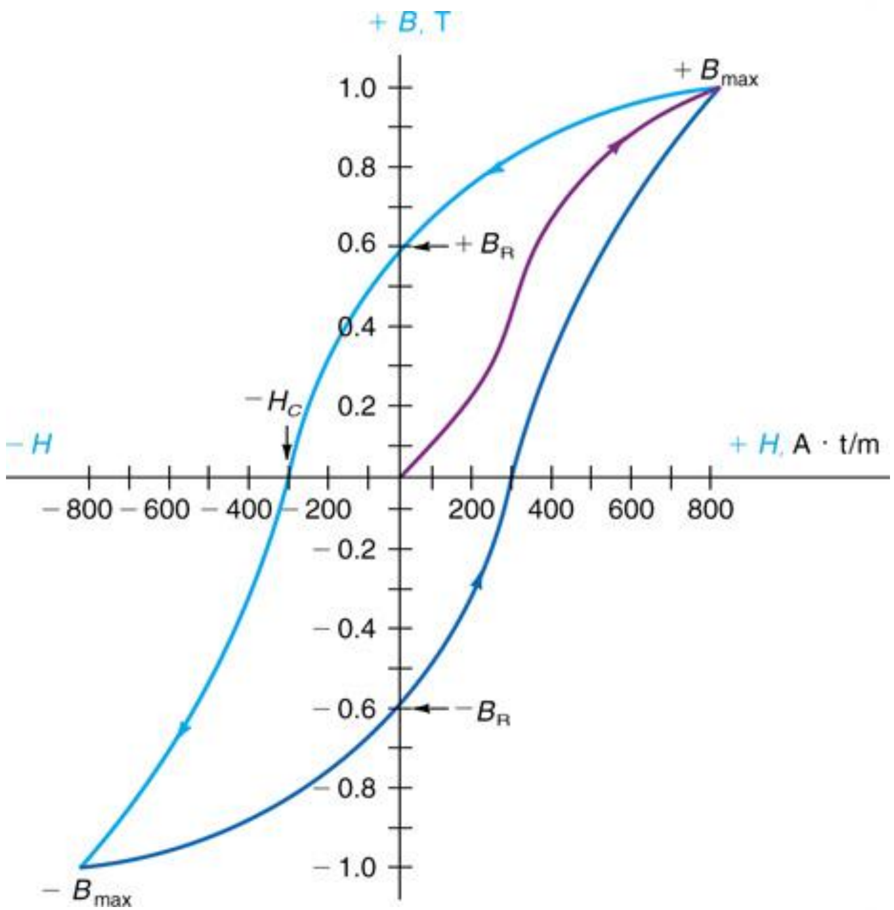

Fig. 14-4: Hysteresis loop for magnetic materials. This graph is a *B-H* curve like Fig. 14-3, but *H* alternates in polarity with alternating current.

Magnetic Hysteresis

- Demagnetization (Also Called Degaussing)
  - To demagnetize a magnetic material completely, the retentivity B_R must be reduced to zero.
  - The practical way to do so is to magnetize and demagnetize the material with a decreasing hysteresis loop:
    - A magnetic field is produced by alternating current.
    - The magnetic field and the magnetic material are moved away from each other, or the current amplitude is reduced.
    - The hysteresis loop then becomes smaller and smaller until it effectively collapses.

Magnetic Hysteresis

- Demagnetization (Also Called Degaussing)
  - This method of demagnetization is called **degaussing**.
  - Applications of degaussing include:
    - Metal electrodes in a color picture tube
    - Erasing the recorded signal on magnetic tape.

Hysteresis and eddy current losses,

Hysteresis loss and eddy current loss, both depend upon magnetic properties of the materials used to construct the core of transformer and its design. So these losses in transformer are fixed and do not depend upon the load current. So core losses in transformer which is alternatively known as iron loss in transformer can be considered as constant for all range of load.

- Hysteresis loss in transformer is denoted as,

  $W_h = K_h f (B_m)^x$

  Eddy current loss in transformer is denoted as,

  $W_e = K_e f^2 (B_m)^2$

- Where, K_h = Hysteresis constant.
- K_e = Eddy current constant.