

# Hysteresis Curve

## Objective :

Observe physical performance hysteresis of magnetic material under external magnetic field.

## Apparatus :

Hysteresigraph (Hyster-G), function generator, oscilloscope, iron wire, soft iron rod

## Principle :

### A. Hysteresis Curve

When an external magnetic field ( $H$ ) is applied to magnetic material, the magnetic dipoles ( $M$ ) align themselves with it. The curve increases rapidly and approach magnetic saturation called magnetic saturation ( $M_s$ ). As the magnetic field reduces, the curve decreases monotonically and remains non-zero as an offset from the origin called magnetic remanence ( $M_r$ ) when no magnetic field applied.

Magnetic dipole decreases when opposite magnetic field applied and becomes zero, and the field is called magnetic coercivity ( $H_c$ ).

Increasing the opposite field results non-zero dipoles. Periodic magnetic field induces specific  $M$ - $H$  curve, and so-called Hysteresis Curve. In this experiment we used 「Hysteresis graph (Hyster-G)」, function generator and oscilloscope to observed hysteresis curve.

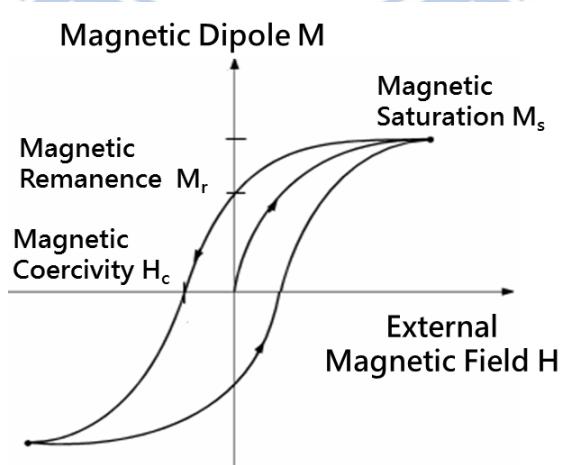


Figure 1. Hysteresis Curve

## Remarks :

1. Set the sample first and then turn on the function generator.
2. After experiment, turn it off and take out the sample.

## Procedure :

1. Set up apparatus as shown as figure 3.

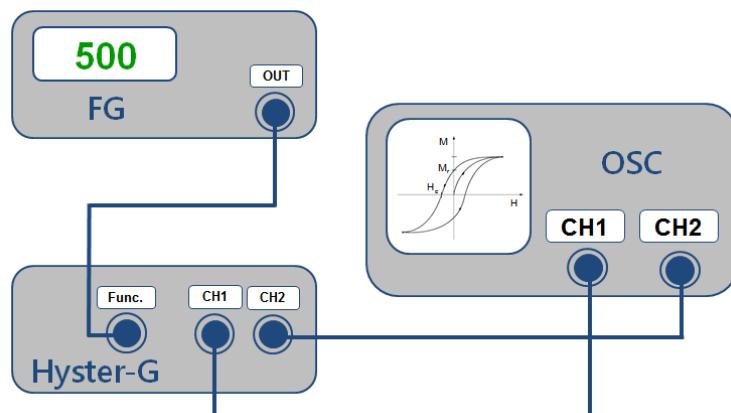


Figure 3. Experiment set-up

2. Switch to X-Y mode on oscilloscope, and set input AC voltage as sine wave with 100.0 Hz, amplitude can be adjusted 5.0 V.
3. Turn on Hyster-G (switch is on the back side), set the sample in the coil by inserting it from right side, and then hysteresis curve is presented on the screen.
4. Set 4.0 and 6.0 volts, observe and record the difference of hysteresis curve like remanence ( $M_r$ ), coercively ( $H_c$ ), and asymptote.
5. Choose three different frequency (80.0, 120.0 and 200.0 Hz) and repeat above steps. Observe hysteresis and record remanence, asymptote, and coercively.

## Questions :

1. When asymptote occurs, what will happen with increasing voltage? Do remanence and coercively change? Please Explain.
2. What are the differences of hysteresis with different input frequency? Please Explain.