**Class\_\_\_\_\_\_ Student ID\_\_\_\_\_\_\_\_\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Instructor\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pre-class Assignment Grade\_\_\_\_\_\_\_\_\_\_\_ Final Grade\_\_\_\_\_\_\_\_\_\_**

**Experiment: Observation of Hysteresis Loops with an Oscilloscope**

1. **Experiment Objectives**
2. **Pre-Lab**

1. Definition of remanent magnetization, coercivity, basic magnetization curve, dynamic hysteresis loop:

2. Which voltage does the X-axis signal measured by the oscilloscope represent? What is the relationship between and the magnetic field strength 𝐻? (Provide the formula). Which voltage does the X-axis signal measured by the oscilloscope represent? What is the relationship between and the magnetic field strength B? (Provide the formula).

1. **Experiment Phenomena and Data Recording**

**Sample 1: Saturated Hysteresis Loop**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency | *R*1 | *R*2 | *C* |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40 *Hz* |  |  |  | *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |
|  | | | |  | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |

**Sample 1: Basic Magnetization Curve**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency | *R*1 | *R*2 | *C* |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40 *Hz* |  |  |  | *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |

**Sample 2: Saturated Hysteresis Lines**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency | *R*1 | *R*2 | *C* |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40 *Hz* |  |  |  | *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |
|  | | | |  | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |

**Sample 2: Basic Magnetization Curve**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency | *R*1 | *R*2 | *C* |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40 *Hz* |  |  |  | *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |

**Sample 2: Hysteresis Loop**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency | *R*1 | *R*2 | *C* |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 100 *Hz* |  |  |  | *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |
|  | | | |  | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| *UX* |  |  |  |  |  |  |  |  |  |  |
| *UY* |  |  |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **Instructor Signature** |  |

1. **Data Processing and Plotting**
2. Please plot the hysteresis loops and basic magnetization curves for both samples using plotting software or graph paper.
3. Compare the hysteresis loops of the two samples at the same frequency.
4. Compare the hysteresis loops of Sample 2 at different frequencies.
5. Calculate the residual magnetism and coercive force for both samples.
6. **Experimental Conclusions and Phenomenon Analysis**

Differences Between Sample 1 and Sample 2 and the Effect of Frequency on the Hysteresis Loop

1. **Questions**
2. Two materials exhibit hysteresis loops, one wide and the other narrow. What types of magnetic materials do they each belong to? What are their respective applications?
3. A steel component has been accidentally magnetized. Please design a demagnetization procedure for it.