Magnetization Properties

1. Objectives

Measure the magnetization curves of a variety of magnetic materials to understand the basic concepts of ferromagnetism. Understand the properties of different materials under different frequency, temperature. Learn the method of using X-Y recorder and oscilloscope.

2. Experimental results

2.1 Properties of specimens and different materials

The basic information of specimens is shown on Table 2.1 *Properties of specimens*.

Table 2.1: Properties of specimens

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Material | Type | Le m | Ae | turn | turn |
| Silicon steel | 6.5%Si |  |  | 30 | 30 |
| Amorphous | MB |  |  | 5 | 5 |
| Ferrite | H5A |  |  | 15 | 15 |

Where, is the average length of the inner and outer perimeters of the toroidal specimen, is the cross-sectional area, and turns are the turns of the coil.

Below are the equations to calculate:

|  |  |  |
| --- | --- | --- |
|  |  | (2.1) |
|  |  | (2.2) |

2.2 Measurement of the magnetization curves

The data from X-Y Recorder and B-H Curve Trainer is shown on Table 2.2 *Measurement result*.

Table 2.2: Measurement result

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| hgMaterial | X-Y Recorder | | Scale Factors | |
| Range  X axis  V/cm | Range  Y axis  V/cm | A/m/cm | T/cm |
| Silicon  Steel | 0.5 | 0.1 | 35.76 | 0.163 |
| 0.5 | 0.1 | 35.76 | 0.163 |
| 0.5 | 0.1 | 35.76 | 0.163 |
| Amorphous | 0.5 | 0.5 | 4.55 | 0.085 |
| Ferrite  (H5A) | 0.25 | 0.25 | 28.14 | 0.082 |
| 0.25 | 0.25 | 28.14 | 0.082 |
| 0.25 | 0.25 | 28.14 | 0.082 |

2.3 Readings from the graph and Measurement result

We can read the data from Fig. 1, Fig. 2 and Fig. 3, thus we have Table 2.3 *Readings from the graph and Measurement result*.

Table 2.3: Readings from the graph and Measurement result

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | Frequency Hz | Temperature℃ | Reading from the graph | | | Measurement result | | |
| Hc  cm | Br  cm | Bm  cm | Hc  A/m | Br  T | Bm  T |
| Silicon  steel | 100 | 24 | 1.46 | 5.38 | 6.80 | 52.21 | 0.88 | 1.11 |
| 200 | 1.80 | 5.69 | 6.73 | 64.37 | 0.93 | 1.10 |
| 500 | 2.43 | 5.88 | 6.69 | 86.90 | 0.96 | 1.09 |
| Amorphous | 1000 | 24 | 0.58 | 7.08 | 7.11 | 2.64 | 0.60 | 0.60 |
| Ferrite  (H5A) | 1000 | 0 | 0.46 | 1.00 | 5.31 | 12.94 | 0.08 | 0.44 |
| 24 | 0.41 | 1.00 | 4.90 | 11.54 | 0.08 | 0.44 |
| 73 | 0.31 | 0.88 | 3.91 | 8.72 | 0.07 | 0.32 |

3. Discussion and Conclusion

3.1 Frequency dependency of the hysteresis curve

TBD

3.2 Temperature dependency of the hysteresis curve\

TBD

3.3 Relationship between the differences in shapes of the three samples

TBD