**班级\_\_\_\_\_\_\_\_\_\_\_ 学号\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 姓名\_\_\_\_\_\_\_\_\_\_\_\_ 教师签字\_\_\_\_\_\_\_\_\_\_\_\_**

**实验日期\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_预习成绩\_\_\_\_\_\_\_\_\_ 总成绩\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**实验名称** **巨磁阻效应与应用**

1. **实验预习**
2. 什么是磁电阻效应？
3. 巨磁阻效应产生的机制是什么？
4. **实验现象及原始数据记录**
5. GMR模拟传感器的磁电转换特性测量

表 1 GMR模拟传感器磁电转换特性的测量

电桥电压：4V

|  |  |  |  |
| --- | --- | --- | --- |
| 磁感应强度*B*/Gauss | | 输出电压*U*out/mV | |
| 励磁电流*I*M/mA | 磁感应强度*B*/Gauss | 减小磁场 | 增大磁场 |
| 100 |  |  |  |
| 90 |  |  |  |
| 80 |  |  |  |
| 70 |  |  |  |
| 60 |  |  |  |
| 50 |  |  |  |
| 40 |  |  |  |
| 30 |  |  |  |
| 20 |  |  |  |
| 10 |  |  |  |
| 5 |  |  |  |
| 0 |  |  |  |
| -5 |  |  |  |
| -10 |  |  |  |
| -20 |  |  |  |
| -30 |  |  |  |
| -40 |  |  |  |
| -50 |  |  |  |
| -60 |  |  |  |
| -70 |  |  |  |
| -80 |  |  |  |
| -90 |  |  |  |
| -100 |  |  |  |

1. GMR磁阻特性测量

表 2 GMR磁阻特性的测量

磁阻两端电压：4V

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 磁感应强度*B*/Gauss | | 磁阻*R*/Ω | | | |
| 减小磁场 | | 增大磁场 | |
| 励磁电流*I*M/mA | 磁感应强度*B*/Gauss | 磁阻电流*I*R/mA | 磁阻*R*/Ω | 磁阻电流*I*R/mA | 磁阻*R*/Ω |
| 100 |  |  |  |  |  |
| 90 |  |  |  |  |  |
| 80 |  |  |  |  |  |
| 70 |  |  |  |  |  |
| 60 |  |  |  |  |  |
| 50 |  |  |  |  |  |
| 40 |  |  |  |  |  |
| 30 |  |  |  |  |  |
| 20 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 0 |  |  |  |  |  |
| -5 |  |  |  |  |  |
| -10 |  |  |  |  |  |
| -20 |  |  |  |  |  |
| -30 |  |  |  |  |  |
| -40 |  |  |  |  |  |
| -50 |  |  |  |  |  |
| -60 |  |  |  |  |  |
| -70 |  |  |  |  |  |
| -80 |  |  |  |  |  |
| -90 |  |  |  |  |  |
| -100 |  |  |  |  |  |

1. GMR开关（数字）传感器的磁电转换特性曲线测量

表3 GMR开关传感器的磁电转换特性测量

高电平= V 低电平= V

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 减小磁场 | | | 增大磁场 | | |
| 开关动作 | 励磁电流*I*M/mA | 磁感应强度*B*/Gauss | 开关动作 | 励磁电流*I*M/mA | 磁感应强度*B*/Gauss |
| 关 |  |  | 关 |  |  |
| 开 |  |  | 开 |  |  |

1. 用GMR传感器测量电流

表4 用GMR模拟传感器测量电流

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 待测电流*I*/mA | | | 300 | 200 | 100 | 0 | -100 | -200 | -300 |
| 输出电压/mV | 低磁偏置  （约25mV) | 减小电流 |  |  |  |  |  |  |  |
| 增加电流 |  |  |  |  |  |  |  |
| 适当磁偏置  （约150mV) | 减小电流 |  |  |  |  |  |  |  |
| 增加电流 |  |  |  |  |  |  |  |

1. GMR梯度传感器的特性及应用

表5 齿轮角位移的测量

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 转动角度/度 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 输出电压/mV |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. 磁记录与读出

表6 二进制数字的写入与读出

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 十进制数字 |  | | | | | | | |
| 二进制数字 |  |  |  |  |  |  |  |  |
| 磁卡区域号 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 读出电平 |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **教师** | **姓名** |
| **签字** |  |

1. **数据处理**
2. GMR模拟传感器的磁电转换特性测量

根据螺线管上标明的线圈密度24000匝/m，由B=μ0nI计算出螺线管内的磁感应强度B。以磁感应强度作横坐标，电压表的读数为纵坐标做出磁电转换特性曲线。

1. GMR磁阻特性测量

以磁感应强度B作横坐标，磁阻为纵坐标作出磁阻特性曲线。

1. GMR开关（数字）传感器的磁电转换特性曲线测量

以磁感应强度B作横坐标，电压读数为纵坐标做出开关传感器的磁电转换特性曲线。

1. 用GMR模拟传感器测量电流

以电流读数作横坐标，电压表的读数为纵坐标作图，分别做出低磁偏置和适当磁偏置条件下电流增大和减小的关系曲线（4条）。

1. GMR梯度传感器的特性及应用

测量转动角度和输出电压的关系曲线。

1. 磁记录与读出

记录二进制数字的写入与读出表。

1. **实验结论及现象分析**
2. **讨论题**

1. 在磁阻特性测量实验中，为什么增加磁场和减小磁场获得的曲线不重合？

2. 不同磁偏置影响电流测量灵敏度的原因是什么？