**四．实验内容及数据处理**

**1、测量霍尔片的输出电压UH与输入电流I的关系曲线，要求电流源2.00-8.00mA，间隔1.00mA，每个测量点应测B、I与-B、-I组合的四组数值。画出UH-I关系曲线，计算KH、RH和载流子浓度n的数值和不确定度。**

在IM = 500mA时测的如下数据：

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| I(mA) | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 7.30 |
| U1( B, I) | -53.1 | -80.6 | -108.5 | -136.0 | -163.2 | -190.0 | -197.8 |
| U2( B,-I) | 52.6 | 79.0 | 105.3 | 131.2 | 156.9 | 182.1 | 189.6 |
| U3(-B,-I) | -47.1 | -70.4 | -93.4 | -116.2 | -137.4 | -159.7 | -166.5 |
| U4(-B, I) | 46.9 | 69.7 | 91.3 | 112.5 | 133.3 | 154.5 | 160.8 |
| UH(mV) | -49.93 | -74.93 | -99.63 | -123.98 | -147.70 | -171.58 | -178.68 |
| U0(mV) | -2.93 | -4.88 | -7.28 | -9.63 | -12.35 | -14.48 | -15.03 |

UH = (U1-U2+U3-U4)/4

UH = (U1-U2-U3+U4)/4

拟合：

查表知，此时磁感应强度B = 127.1mT

由UH = IB/ned = RHIB/d = KHIB 得

n = (B/(ed))\*(I/UH)

= (127.1\*10-3/(-1.6\*10-19\*3\*10-6))/(-24.244)

= 1.092\*1022

RH = (d/B)\*(UH/I)

= (3\*10-6/0.1271)\*(-24.244)

= -5.722\*10-4 m3/C

KH = RH /d

= 1.907\*102 m2/C

不确定度计算：

设k = UH/I, n = 7,

Sk/k = sqrt((r-2-1)/(n-2)) = 4\*10-5

△k = abs( tp(n-2)Sk ) = 2.57\*（24.244）\*4\*10-5

= 2.492\*10-3

由不确定度计算公式可知

△n = △k/k2 = 1.056\*10-8

△R = (d/B)\*△k = 5.883\*10-8 m3/C

△K = △R/d = 1.961\*10-2 m2/C

**2、标定励磁电流IM与磁感应强度B的关系**

在IH = 4.00mA时测的如下数据：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IM(mA) | 0 | 100 | 200 | 300 |
| U1( B, I) | -8.5 | -28.1 | -48.1 | -68.3 |
| U2( B,-I) | 6.4 | 25.8 | 45.5 | 65.2 |
| U3(-B,-I) | 6.4 | -13.8 | -33.4 | -53.3 |
| U4(-B, I) | -8.4 | 11.4 | 31.2 | 51.5 |
| UH(mV) | 0.0 | -19.8 | -39.6 | -59.6 |
| B(mT) | 0.0 | -25.9 | -51.8 | -78.1 |
| 400 | 500 | 600 | 700 | 800 |
| -88.3 | -108.3 | -128.3 | -147.8 | -167.4 |
| 85.0 | 104.8 | 124.3 | 144.2 | 163.3 |
| -73.3 | -93.0 | -112.7 | -132.4 | -152.0 |
| 71.2 | 90.9 | 110.8 | 130.6 | 150.2 |
| -79.5 | -99.3 | -119.0 | -138.8 | -158.2 |
| -104.2 | -130.1 | -156.0 | -181.9 | -207.4 |

关系曲线：

（由于在初次接线时没有检查好，导致励磁电流方向与实验原本设置方向是反向的）

**3、研究锑化铟磁组件的磁电阻效应**

在C、D端恒流，A、B端短路，ICD=1.50mA时测得如下数据：

R(0) = 348.3Ω

（由于励磁电流反向，为了图表清晰，将B做了反向处理）

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| IM(mA) | 0 | 50 | 100 | 150 | 200 | 250 | 300 |
| Ucd(V) | 0.5225 | 0.5316 | 0.5579 | 0.5980 | 0.6503 | 0.7093 | 0.7715 |
| B(mT) | -0.043 | 12.962 | 25.967 | 38.972 | 51.977 | 64.982 | 77.987 |
| △R/R(0) | 0.0001 | 0.0175 | 0.0679 | 0.1446 | 0.2447 | 0.3576 | 0.4767 |
| IM(mA) | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
| Ucd(V) | 0.8662 | 0.9195 | 0.9645 | 1.0049 | 1.0428 | 1.0810 | 1.1185 |
| B(mT) | 103.997 | 130.007 | 156.017 | 182.027 | 208.037 | 234.047 | 260.057 |
| △R/R(0) | 0.6580 | 0.7600 | 0.8461 | 0.9234 | 0.9960 | 1.0691 | 1.1409 |

**4、测定磁间隙水平方向磁场的分布曲线B-x**

在IH = 4.00mA, IM = 500mA时测的如下数据：

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x(mm) | 0 | 2 | 4 | 6 | 8 |
| U1 | -34.6 | -36.3 | -38.7 | -42.1 | -47.2 |
| B(mT) | 0.0454 | 0.0476 | 0.0507 | 0.0552 | 0.0619 |
| 10 | 12 | 14 | 16 | 18 | 20 |
| -56.1 | -69.7 | -89.1 | -103.2 | -106.8 | -107.6 |
| 0.0735 | 0.0914 | 0.1168 | 0.1353 | 0.1400 | 0.1411 |
| x(mm) | 25 | 30 | 35 | 40 | 45 |
| U1 | -107.9 | -108.0 | -108.2 | -108.1 | -108.2 |
| B(mT) | 0.1415 | 0.1416 | 0.1418 | 0.1417 | 0.1418 |
| 48 | 50 | 52 | 54 | 56 | 58 |
| -108.1 | -108.1 | -107.0 | -98.8 | -80.5 | -63.3 |
| 0.1417 | 0.1417 | 0.1403 | 0.1295 | 0.1055 | 0.0830 |

关系图像：

**5、判断载流子类型：电子型**

**6、测量霍尔片中载流子迁移率**

μ = V/E = V/(J/σ) = σv/(I/bd) = σ/(ne) = σRH

又有R = U34/I = l/(σbd)

所以σ = lI/(bdU34)

综上，μ = (RHl)/(bd)\*(I/U34)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| I(mA) | 0.00 | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 |
| U34(mV) | 1 | 1123 | 2258 | 3396 | 4566 | 5750 | 6946 |

计算可得，μ = 49.46%