

**物 理 实 验 报 告**



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**实验名称： 太阳能电池的特性测量**

**实验日期 10.31 指导教师**

1. **实验目的**

**测量不同照度下太阳能电池的伏安特性、开路电压U0和短路电流Is**

**研究太阳能电池的特性，以便在生产生活中提高太阳能电池效率**

**二、实验仪器与实验方法**

**实验仪器**

**太阳能电池实验装置包括：太阳能电池两块、插件板(A4大小)、万用表两块(附带表笔)、卤素灯、电压范围为2~12V的稳压源。**

**实验方法**

**(1)通过对太阳能电池基本特性的测量，了解和掌握它的特性和有关的测量方法。**

**(2)测量不同照度下太阳能电池的伏安特性、开路电压和短路电流。**

**(3)在不同照度下，测定太阳能电池的输出功率和负载电阻的函数关系。**

**(4)确定太阳能电池的最大输出功率以及相应的负载电阻和填充因数**

1. **测量内容及数据处理**

 Is=45mA;Uo(V)=2.05

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| I/mA | 35 | 35 | 35 | 35 | 35 | 35 | 34.99 | 34.75 | 33.38 | 31.32 | 29.29 | 27.42 | 25.75 | 24.25 | 22.91 | 20.61 | 15.81 | 10.77 | 7.84 | 6.57 |
| U/V | 0.35 | 0.52 | 0.7 | 0.87 | 1.05 | 1.22 | 1.4 | 1.56 | 1.67 | 1.72 | 1.76 | 1.78 | 1.8 | 1.82 | 1.83 | 1.85 | 1.9 | 1.94 | 1.96 | 1.97 |
| R/Ω | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 90 | 120 | 180 | 250 | 300 |
| P/mW | 12.25 | 18.37 | 24.5 | 30.62 | 36.75 | 42.87 | 48.97 | 54.35 | 55.7 | 53.96 | 51.46 | 48.87 | 46.4 | 44.1 | 41.97 | 38.22 | 29.99 | 20.87 | 15.38 | 12.95 |

Is=35mA;Uo(V)=2.03

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| 内容 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| I/mA | 35 | 35 | 35 | 35 | 35 | 35 | 34.99 | 34.75 | 33.38 | 31.32 | 29.29 | 27.42 | 25.75 | 24.25 | 22.91 | 20.61 | 15.81 | 10.77 | 7.84 | 6.57 |
| U/V | 0.35 | 0.52 | 0.7 | 0.87 | 1.05 | 1.22 | 1.4 | 1.56 | 1.67 | 1.72 | 1.76 | 1.78 | 1.8 | 1.82 | 1.83 | 1.85 | 1.9 | 1.94 | 1.96 | 1.97 |
| R/Ω | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 90 | 120 | 180 | 250 | 300 |
| P/mW | 12.25 | 18.37 | 24.5 | 30.62 | 36.75 | 42.87 | 48.97 | 54.35 | 55.7 | 53.96 | 51.46 | 48.87 | 46.4 | 44.1 | 41.97 | 38.22 | 29.99 | 20.87 | 15.38 | 12.95 |

 Is=25mA;Uo(V)=1.98

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| 内容 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| I/mA | 25 | 25 | 25 | 24.99 | 24.93 | 24.56 | 23.69 | 22.62 | 21.54 | 20.52 | 19.57 | 18.68 | 17.87 | 15.19 | 12.37 | 10.43 | 7.63 | 6.4 | 4.84 | 3.54 |
| U/V | 0.25 | 0.75 | 1.25 | 1.37 | 1.5 | 1.6 | 1.66 | 1.7 | 1.72 | 1.74 | 1.76 | 1.77 | 1.79 | 1.82 | 1.86 | 1.88 | 1.91 | 1.92 | 1.93 | 1.95 |
| R/Ω | 10 | 30 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 120 | 150 | 180 | 250 | 300 | 400 | 550 |
| P/mW | 6.25 | 18.75 | 31.25 | 34.36 | 37.3 | 39.19 | 39.27 | 38.37 | 37.12 | 35.78 | 34.45 | 33.16 | 31.93 | 27.69 | 22.97 | 19.59 | 14.55 | 12.28 | 9.36 | 6.9 |

 Is=15mA;Uo(V)=1.91

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| 内容 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| I/mA | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14.98 | 14.94 | 14.8 | 14.54 | 14.19 | 13.79 | 11.53 | 8.91 | 6.09 | 4.62 | 3.12 | 2.35 | 1.58 |
| U/V | 0.15 | 0.45 | 0.75 | 1.05 | 1.2 | 1.27 | 1.35 | 1.42 | 1.49 | 1.55 | 1.6 | 1.63 | 1.66 | 1.73 | 1.78 | 1.83 | 1.85 | 1.87 | 1.88 | 1.89 |
| R/Ω | 10 | 30 | 50 | 70 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 150 | 200 | 300 | 400 | 600 | 800 | 1200 |
| P/mW | 2.25 | 6.75 | 11.25 | 15.75 | 18 | 19.12 | 20.24 | 21.33 | 22.31 | 23 | 23.25 | 23.14 | 22.83 | 19.95 | 15.89 | 11.14 | 8.55 | 5.83 | 4.42 | 2.98 |

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| 测量值/组数 | 第一组 | 第二组 | 第三组 | 第四组 |
| Rmax/Ω | 40 | 50 | 70 | 110 |
| Ri/Ω | 45.3 | 57.7 | 79.2 | 127.3 |
| Rmax/Ri | 0.8822 | 0.8667 | 0.8836 | 0.8639 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 测量值/组数 | 第一组 | 第二组 | 第三组 | 第四组 |
| Pmax/mW | 71.9 | 55.7 | 39.27 | 23.25 |
| (U0\*IS)/ mW | 91.82 | 70.67 | 49.51 | 28.65 |
| F=Pmax/(U0\*IS) | 0.783 | 0.7881 | 0.7932 | 0.8114 |

**四、小结**

**太阳能电池功率随电阻增大先增大后减小，有最大值。**

**实际最大功率的电阻值总小于理论最大功率对应的电阻值。**

**太阳能电池电压电流越大，利用效率越低。**

**在某个电阻值之后，阻值增大电流几乎不变电压变化变大。**

**五、思考题**

**温度会对太阳能电池带来什么影响？**

**温度越高，太阳能电池内阻越大，最大输出功率的效率会变低。**