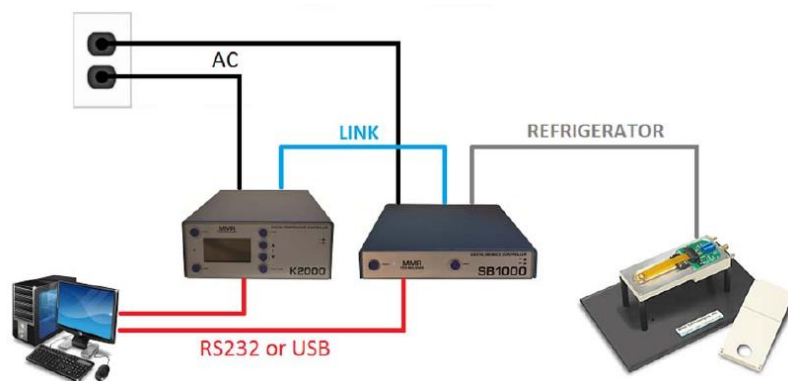
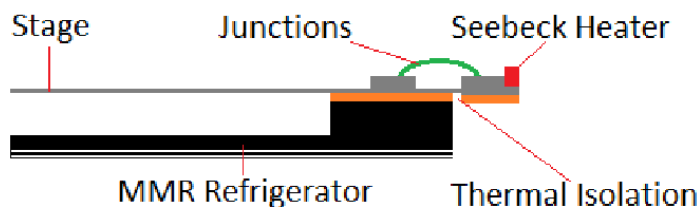


赛贝克系数测量仪

赛贝克效应是指在两种不同导体组成的闭合电路中，如果两个接点的温度不同，则两接点间会有电动势产生。赛贝克系数测量仪是用来精确测量导电物质、金属、有机导体和半导体的赛贝克系数的仪器。赛贝克系数测量仪主要包括赛贝克效应控制器、赛贝克样品台、温度控制器三部分。



赛贝克平台依附在制冷台上可以提供 70K-730K 和室温-730K 的变温范围，结合温度控制器 AUK2000 可提供精确的温度控制与测量并且拥有极高的稳定性和重复性。该系统控温精度可达到 $\pm 0.1K$ ，分辨率可达到 $\pm 0.01K$ ，对温度的响应速度可达到 $1K/s$ 。



赛贝克系数测量仪的工作原理大致如下，在赛贝克样品台上包含两组热电偶，一组是铜和已

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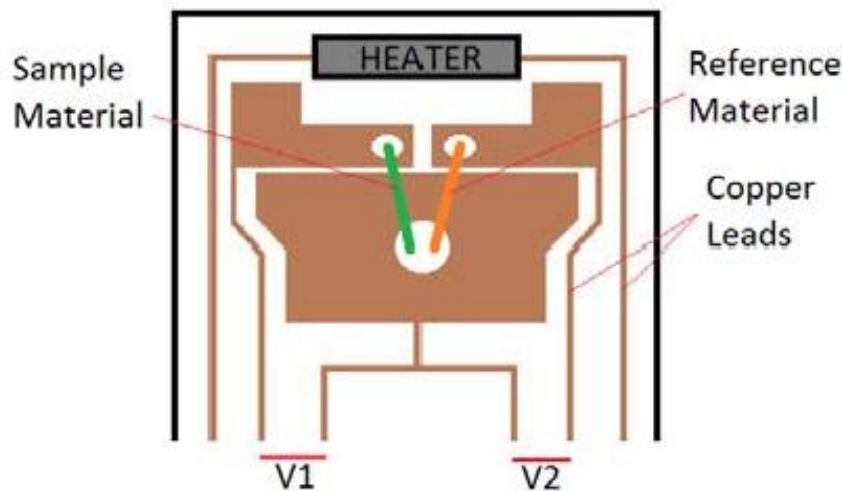
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知热电属性的参考材料构成，一组是铜与待测样品组成(如下图所示)。其中一个接点为参考点，另一个接点为工作点。当参考点与工作接点有温差时就可以分别探测到两端电压 V_1 和 V_2 。即

(1). $V_1 = \epsilon_1 \Delta T(P)$; (2). $V_2 = \epsilon_2 \Delta T(P)$; 所以(3). $\epsilon_1 = \epsilon_2 V_1 / V_2$ 。由于这种直接测量不会有很高的精度，因为仪器工作时会有仪器误差、电线和连接点带来的热电效应和测量误差。为了消除这些误差分别在两个不同输入功率下进行测量即：(4). $V_1(P_1) = \epsilon_1 \Delta T(P_1) + \Delta V_1$; (5). $V_2(P_1) = \epsilon_2 \Delta T(P_1) + \Delta V_2$; ΔV_1 ΔV_2 位系统误差电压（与温度无关）。(6). $V_1(P_2) = \epsilon_1 \Delta T(P_2) + \Delta V_1$; (7). $V_2(P_2) = \epsilon_2 \Delta T(P_2) + \Delta V_2$ 。消除系统误差即可得到 $\epsilon_1 = \epsilon_2 [V_1(P_1) - V_1(P_2)] / [V_2(P_1) - V_2(P_2)]$ ，系统误差得到消除。



赛贝克效应的测量通过赛贝克控制器 AUK1000 来实现的。其结构紧凑小巧，可通过 R232 或者 USB 接口与电脑连接，并通过软件完成测试。赛贝克数字控制器可实时对电压进行测量并提供高精度和高重现性的测量，精度可达到 50nV。



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Experiment Parameters

Experiment Parameters

Experiment Setup

Initial Temperature: 330.0K Standby Temperature: 300.00K Heater Power (mW): 60mW Number of Repetitions: 10
 Final Temperature: 330.0K Auto Standby: YES Gain: 1000 Readings per Average: 2 N=1+2
 Slope K/Min: 15K/min Initial Delay (sec): 30 Reference Material: Kapton-Constantan Seebec Status: Ready
 Temperature Step: 10.0 Opening Delay (sec): 30 High Impedance: NO K2000 Status: Holding at 300.00K

Data View

#	Temp (K)	Sample			Reference			Sample / Ref Ratio (K)	Temp
		Seebec Coeff. (uV/K)	Voltage #1 (uV)	Voltage #2 (uV)	Voltage Diff. (uV)	Seebec Coeff. (uV/K)	Voltage #1 (uV)		
1	330.0								
2	330.0								
3	330.0								
4	340.0								
5	350.0								

Graph View

New Project

Seebec Voltage (uV)

Sample Coefficient (uV/K) Reference Coefficient (uV/K)

Readings

Progress

Step1: Solo Temp
 Step2: Delay
 Step3: Measurement #1
 Step4: Apply Seebec Heat
 Step5: Op Delay
 Step6: Measurement #2
 Step7: Heater Off
 Repetitions Remaining: 10
 Step8: Next Temp

Amplifiers

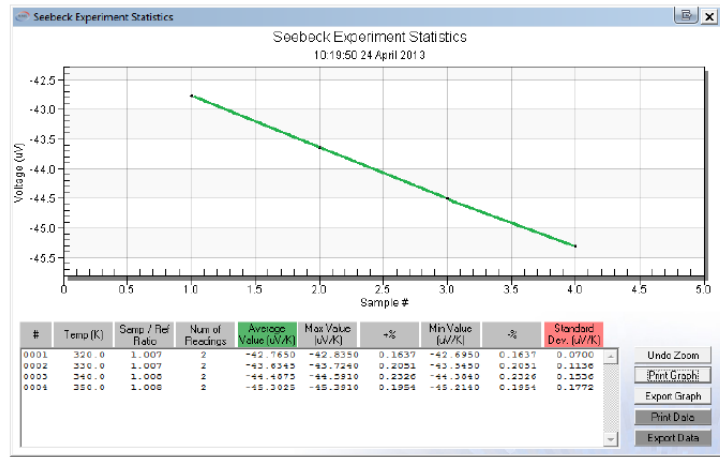
Sample V1 Reference V2

-1000uV
-750uV
-500uV
-250uV
0V
250uV
500uV
750uV
1000uV

Refrigerator Temperature: 300.00K
 Power: 0.00W

Graph Functions Export Print Fullscreen Undo/Zoom

Temperature Data



Experiment Parameters

Experiment Parameters

Experiment Setup

Initial Temperature: 330.0K Standby Temperature: 300.00K Heater Power (mW): 50mW Number of Repetitions: 2
 Final Temperature: 330.0K Auto Standby: YES Gain: 1000 Readings per Average: 2 N=1+2
 Slope K/Min: 15K/min Initial Delay (sec): 30 Reference Material: Kapton-Constantan Seebec Status: Ready
 Temperature Step: 10.0 Opening Delay (sec): 30 High Impedance: NO K2000 Status: Ramping to 300.00K

Data View

#	Temp (K)	Sample			Reference			Sample / Ref Ratio (K)	Temp
		Seebec Coeff. (uV/K)	Voltage #1 (uV)	Voltage #2 (uV)	Voltage Diff. (uV)	Seebec Coeff. (uV/K)	Voltage #1 (uV)		
0101	320.0	-42.835	-147.47	8.16	-151.63	-43.552	-108.33	4.629	330.00
0102	330.0	-43.878	-159.38	81.84	-151.69	-42.892	-108.18	8.818	330.00
0103	330.0	-43.728	-159.41	84.35	-175.56	-43.359	-169.20	-15.44	330.00
0104	330.0	-43.348	-158.88	88.34	-151.25	-42.289	-137.83	8.88	330.00
0105	340.0	-44.292	-179.65	100.23	-171.18	-44.245	-162.64	-62.05	330.00
0106	340.0	-45.285	-189.50	112.64	-151.25	-42.289	-169.96	-10.77	330.00
0107	350.0	-45.181	-192.41	115.83	-171.18	-44.245	-162.67	-11.50	330.00
0108	350.0	-45.117	-192.03	111.51	-151.63	-43.552	-162.91	-111.82	330.00

Graph View

New Project

Seebec Voltage (uV)

Sample Coefficient (uV/K) Reference Coefficient (uV/K)

Readings

Amplifiers

Sample V1 Reference V2

-1000uV
-750uV
-500uV
-250uV
0V
250uV
500uV
750uV
1000uV

-145.37 (uV) -101.36 (uV)

Refrigerator Temperature: 330.23K
 Power: 0.00W

Experiment Complete



◆主要特点

- 宽的操作温度（70-730K）
- 卓越的温度稳定性和重复性（ $\pm 0.1K$ ）
- 高的测量精度（50nV）
- 实时测量与分析
- 可测量柱状或带状样品

◆主要应用

赛贝克系数测量仪是用来精确测量导电物质、金属、有机导体和半导体的赛贝克系数。

◆ 主要参数

Maximum Operating Temperature	70K to 730K
Temperature Stability	$\pm 0.1K$
Resolution for Measurements:	50nV (1000G, 300G, 100G and 30G Amplifiers available)
Power to Heat ample:	Generates a temperature difference across sample, power available Min: 0.01W, Max: 1W
Data Output Options:	Reports can be generated directly through the Software Suite. Exporting data to PNG, JPG, TXT and CSV options available
Sample Length	>2 mm and <10 mm

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