

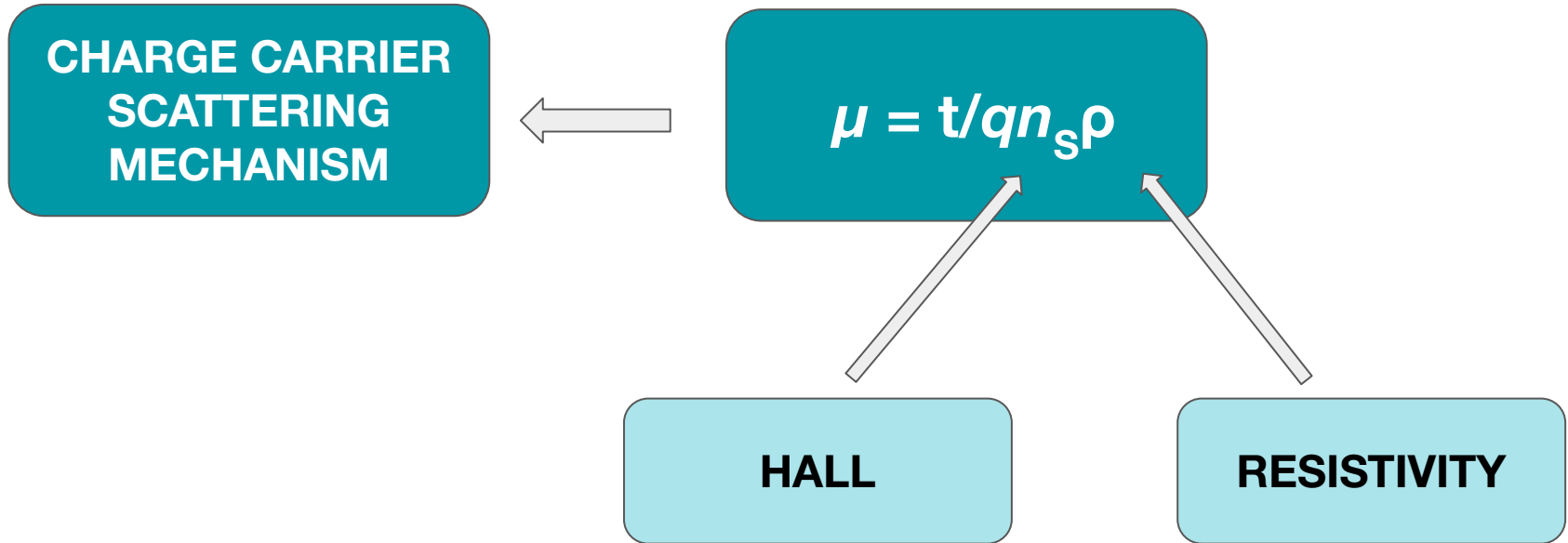
HIGH TEMPERATURE RESISTIVITY SETUP

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(BS-MS Year 2)
- Supervisor:
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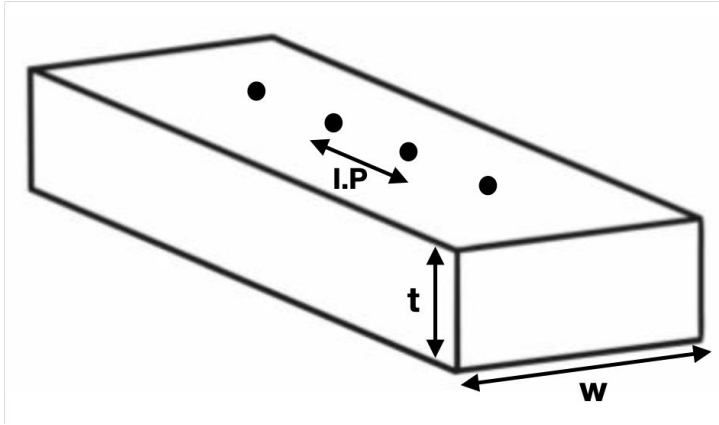
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MOTIVATION

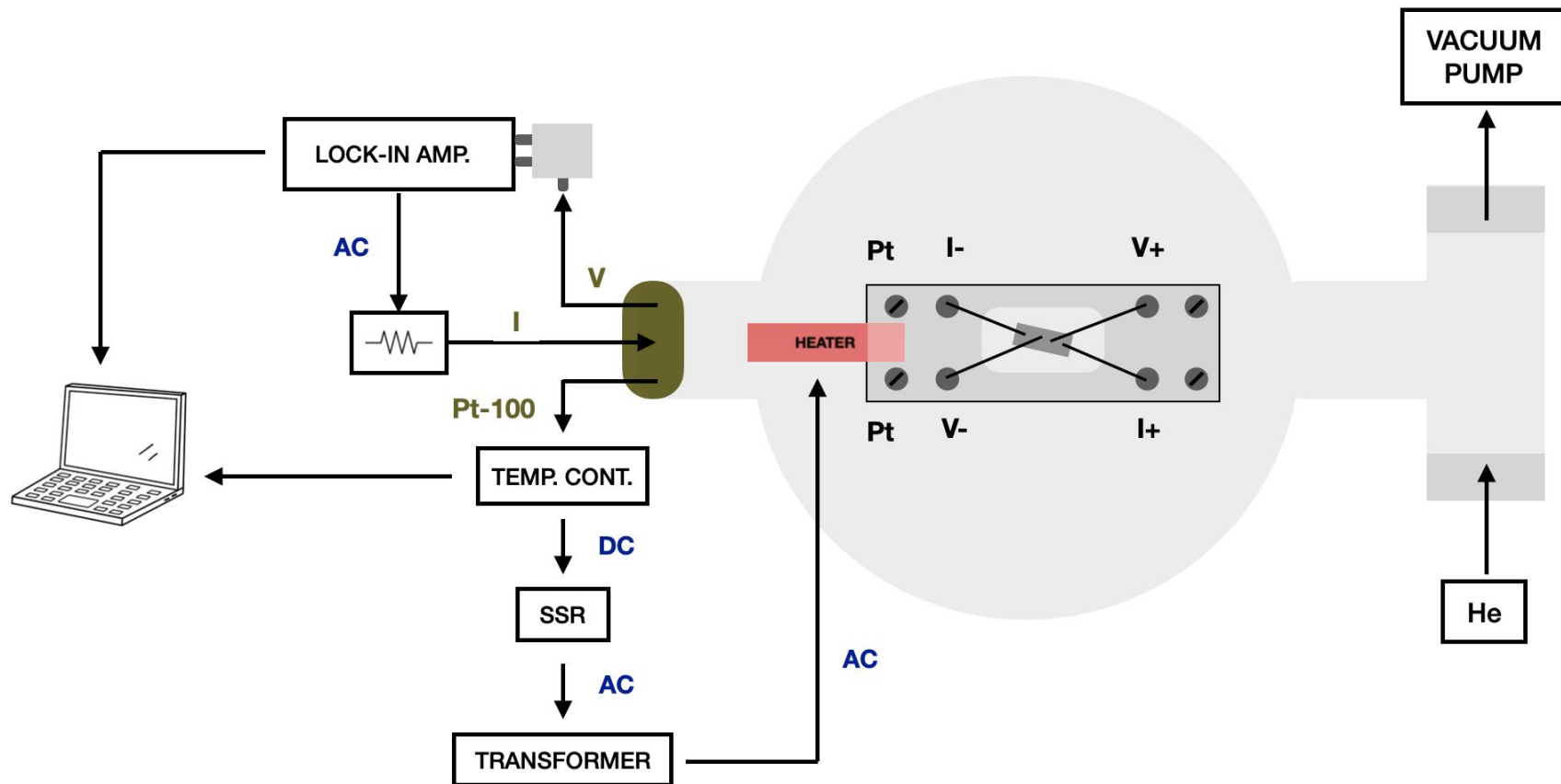


How is it calculated?



$$\rho = \frac{R \cdot A}{l}$$
$$= \frac{V \cdot (w \cdot t)}{I \cdot (I.P)}$$

Schematic diagram of the setup



SAMPLE CHAMBER

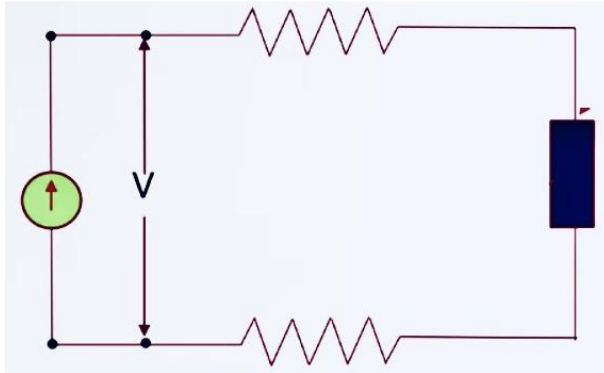
- Made of stainless steel
- Dynamic vacuum upto 10^{-5} to 10^{-6} torr
- Rotary cum turbomolecular pump
- Purge and seal

SAMPLE HOLDER

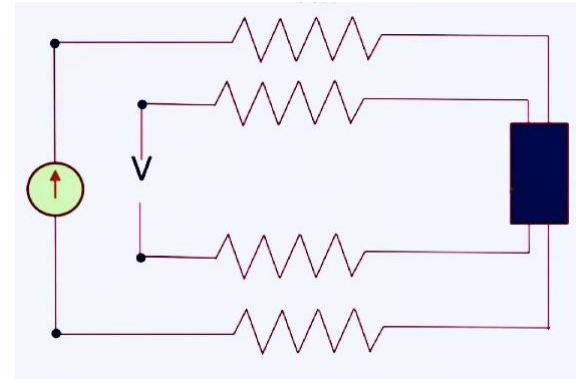
- A **heater** and **Pt-100** are placed inside the sample holder and are contacted with HT silver paste.
- Pt-100 is a RTD (Resistance Temperature Detector)
- Predictable change in resistance with a change in temperature

SAMPLE HOLDER

- 4-probe configuration of current and voltage probes
- Advantage of 4-probe over 2-probe:
 1. Eliminates lead-wire resistance
 2. Eliminates contact resistance



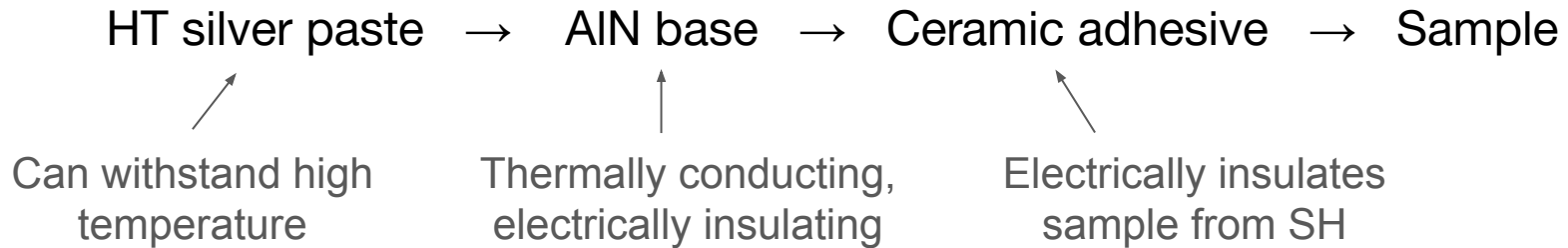
2 PROBE



4 PROBE

SAMPLE HOLDER

- Sample placement -



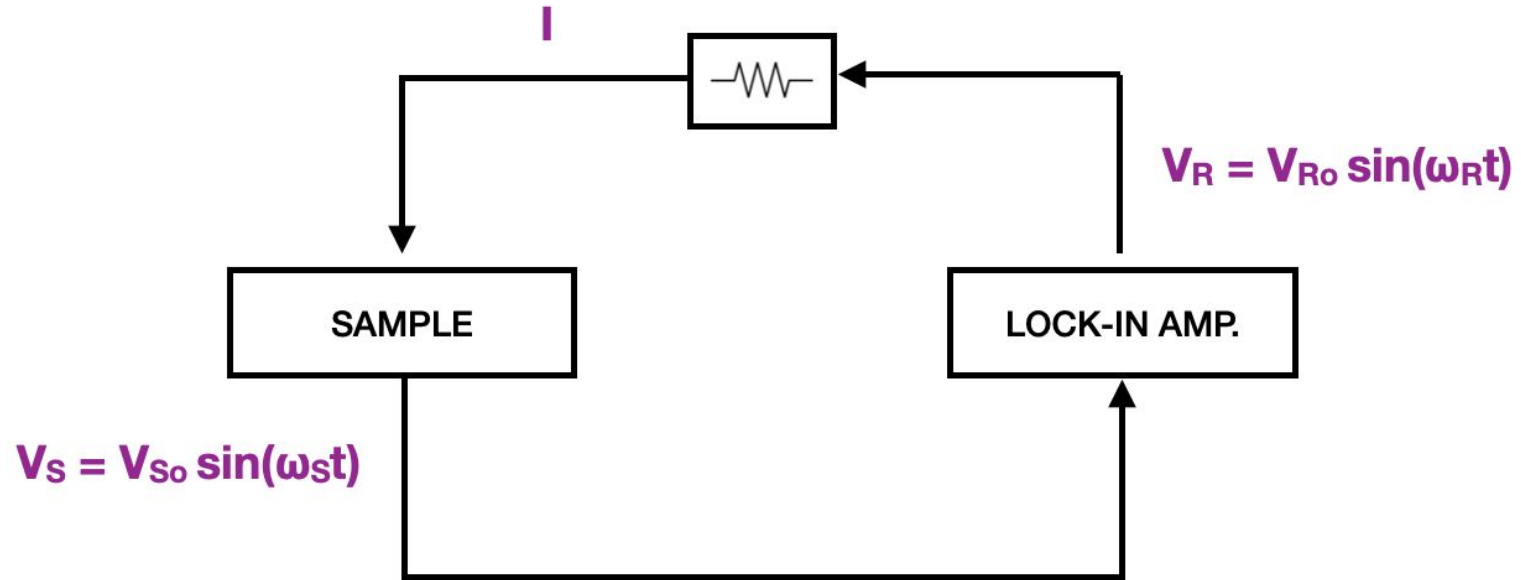
SAMPLE HOLDER

- Stainless steel pressure point contacts (detachable)



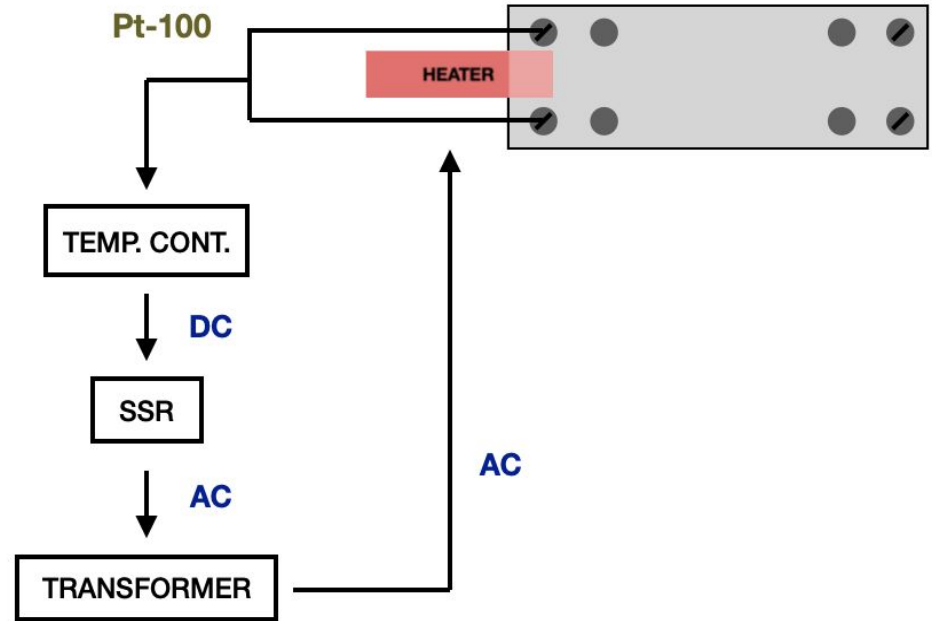
LOCK-IN AMPLIFIER

Purpose: To eliminate noise and provide a constant current source (I)



TEMPERATURE CONTROL

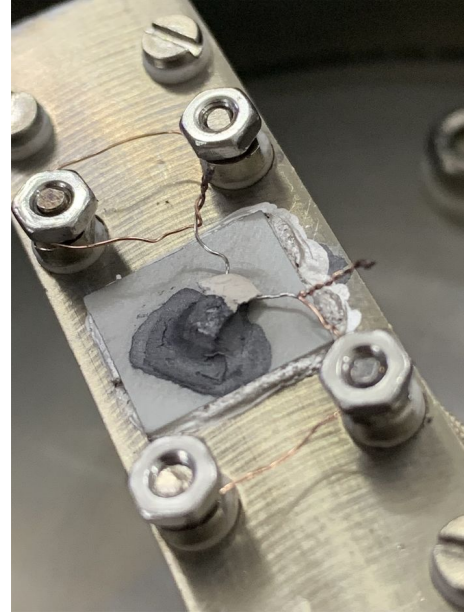
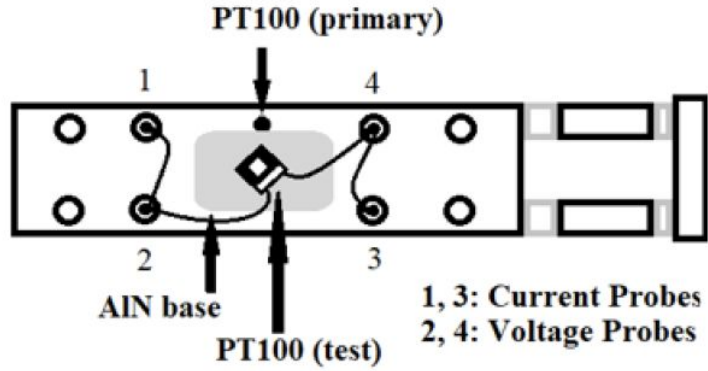
- Temp controller - **PID** mechanism
- Calculates time for which **heater** must remain switched on
- Passes control signal to **SSR** (AC output)



VALIDITY OF OUR SETUP

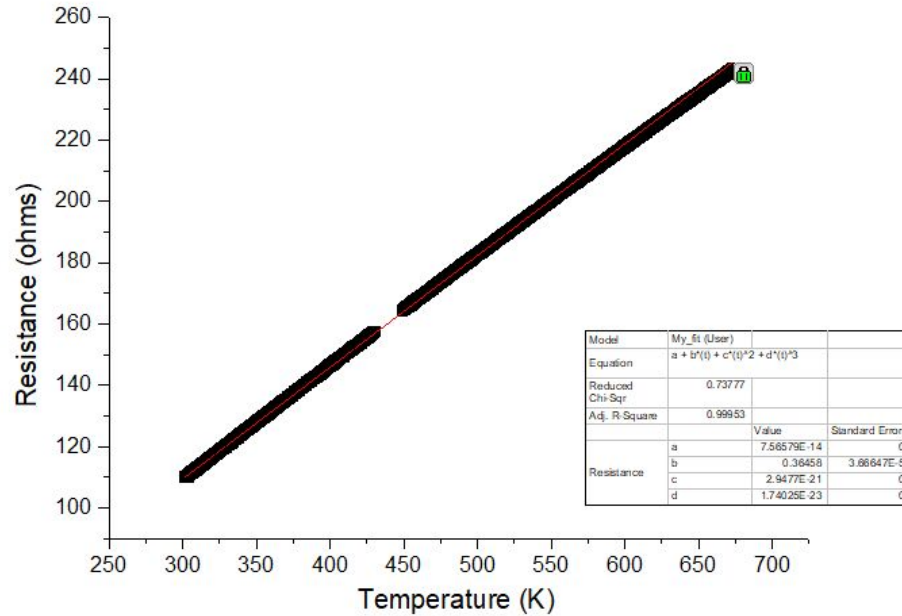
(Data Analysis)

TEMPERATURE TESTS - CALIBRATION

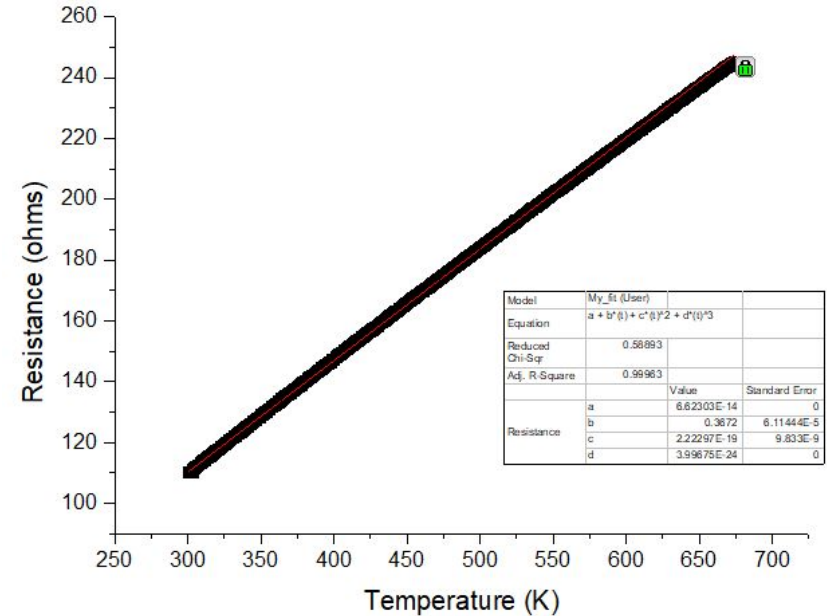


TEMPERATURE TESTS - CALIBRATION

RATE: 50°C/hour

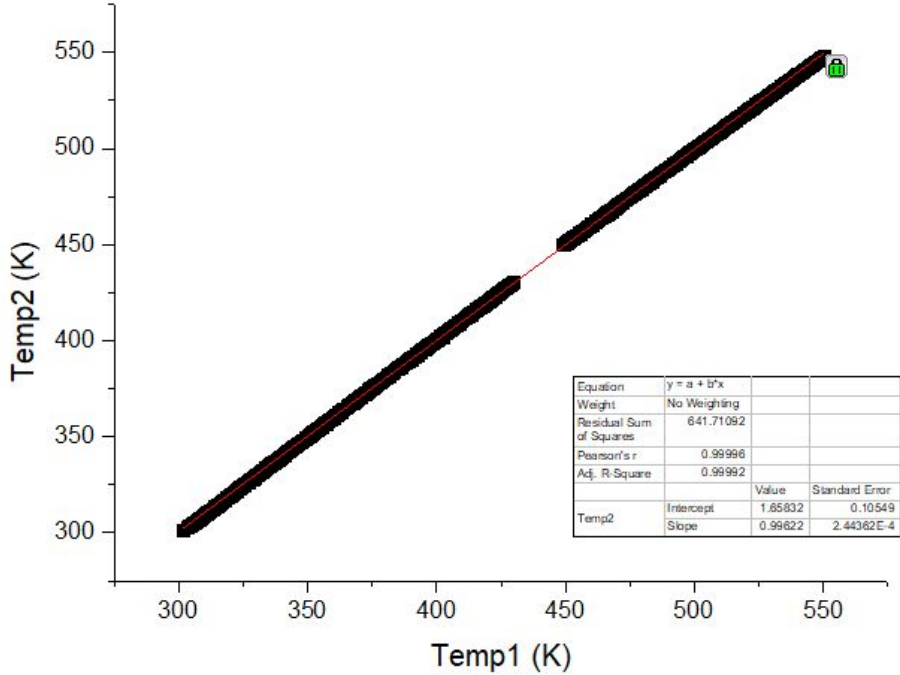


100°C/hour

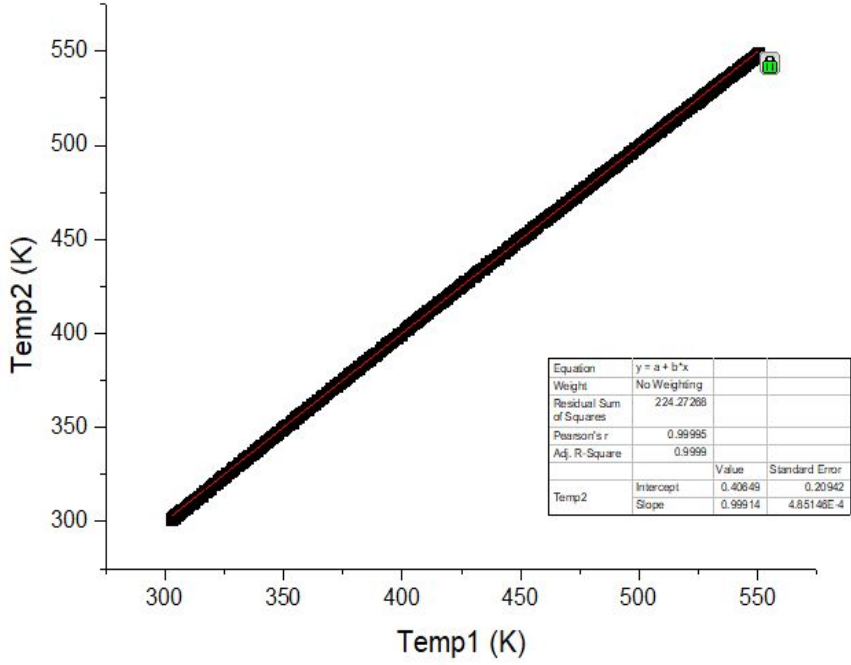


TEMPERATURE TESTS

RATE: 50°C/hour

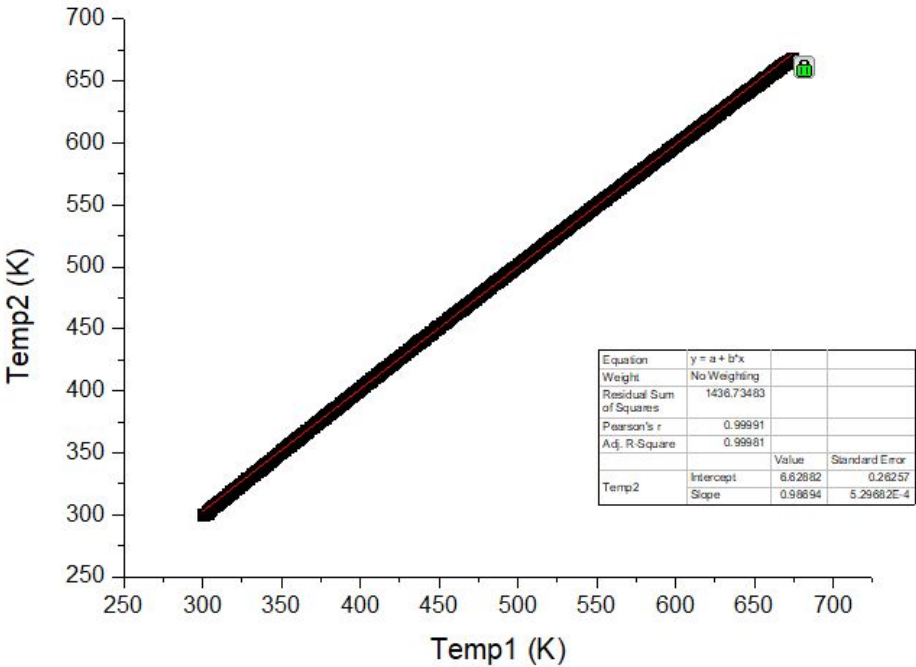


100°C/hour

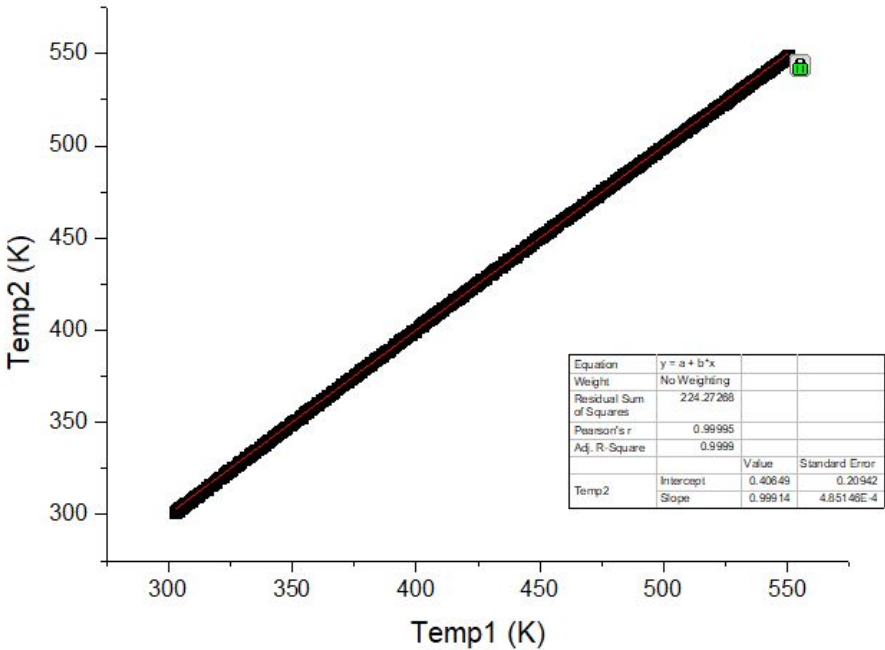


TEMPERATURE TESTS

Temperature: 673 K

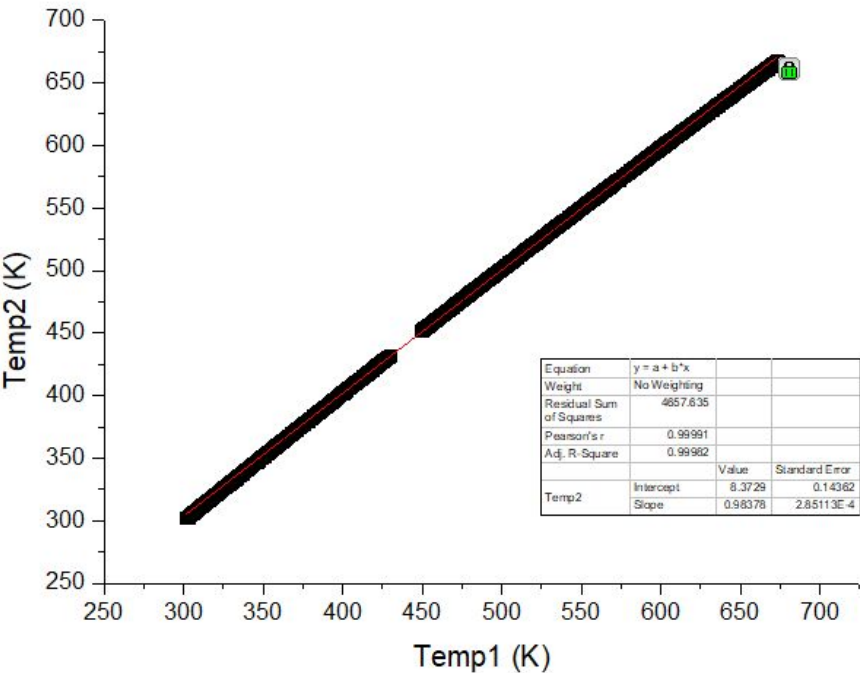


550 K

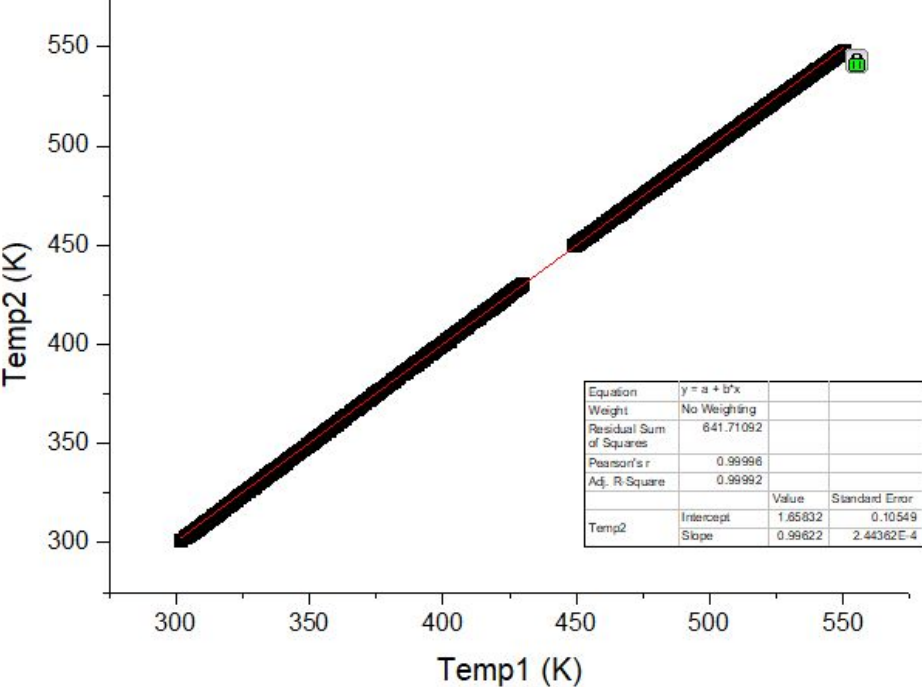


TEMPERATURE TESTS

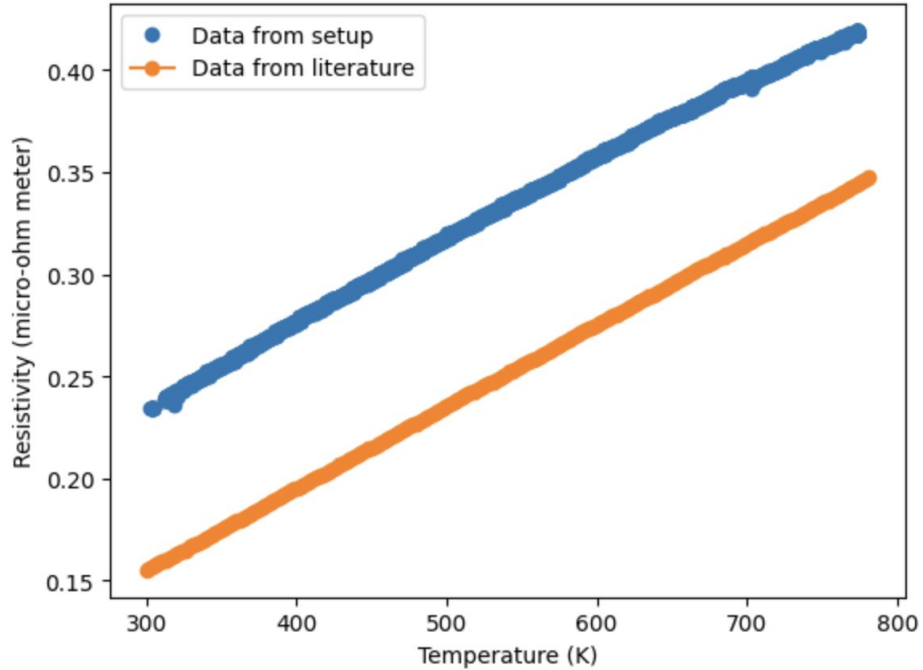
Temperature: 673 K



550 K



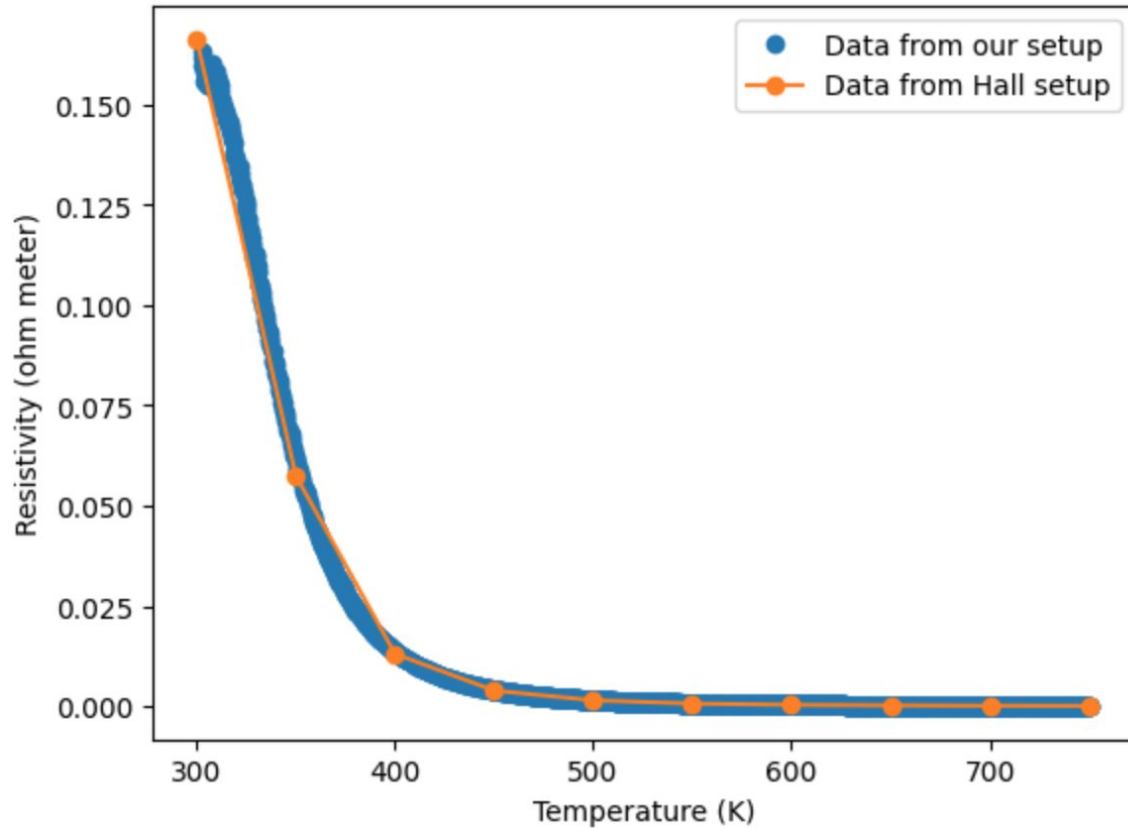
SAMPLE MEASUREMENTS - Nb



$$\rho = m \cdot T + c$$

	DATA FROM SETUP	DATA FROM LITERATURE
SLOPE	0.00039	0.0004
INTERCEPT	0.1208	0.035

VALIDITY OF OUR SETUP - Ge



IMPROVEMENTS

- Ceramic coating on upper and lower lids to prevent them from heating
- Radiation shield / reflective surface to prevent loss of heat due to radiation
- Thermocouple instead of Pt-100

THANK YOU