Dane Weitmann

Accuracy of Thermal Conductivity Analyzer

Overview

- Background
- Method
- Results
- Summary
- Questions

Thermal Conductivity

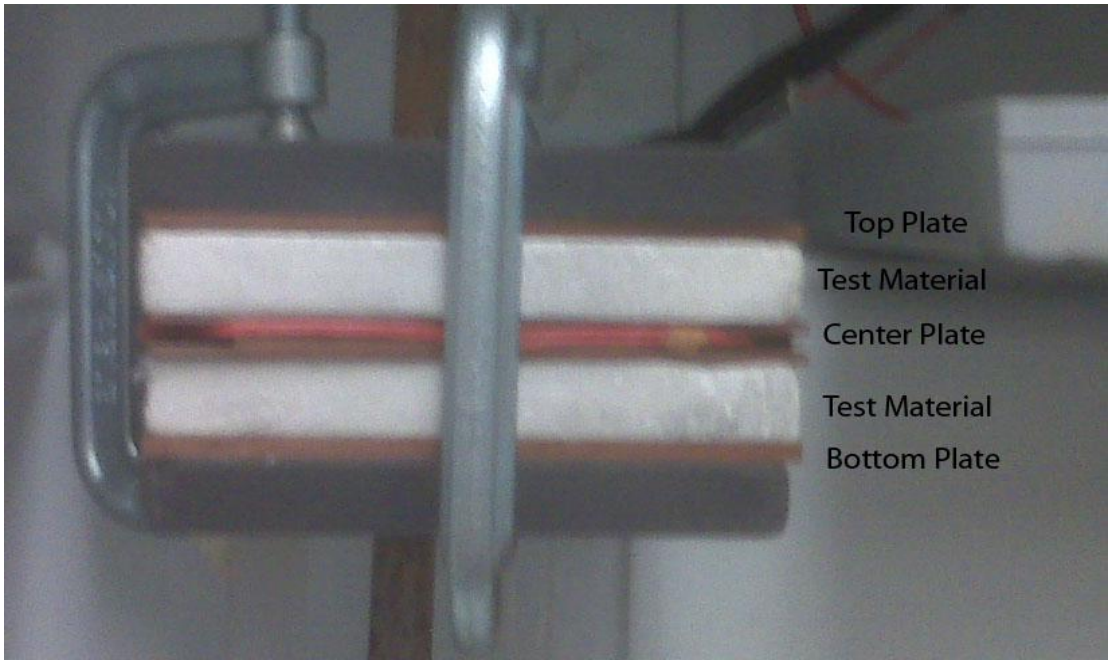
- Material Property that indicates its ability to conduct heat.

Or

- The quantity of heat transmitted through a thickness due to a temperature difference

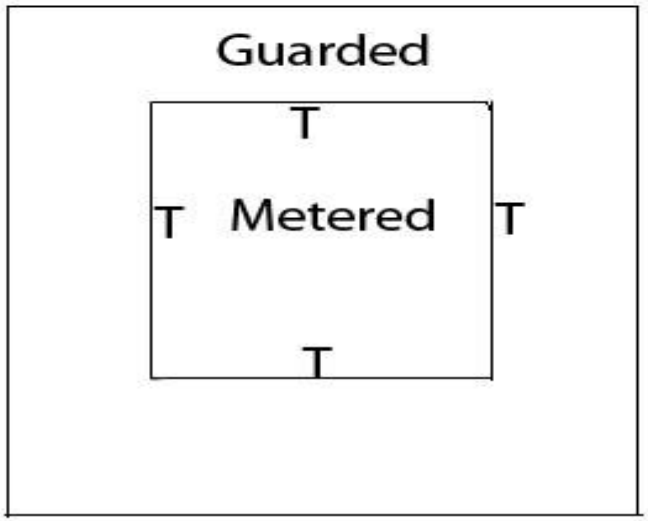
Background

- Guarded Hot Plate Method
  - Holds heat flow in two directions
  - Creates a simple one directional problem



Background

- Middle Plate has two sections
  - Metered - Central, testing area
  - Guarded – Perimeter, holds temperate across area
  - T is location of thermocouples



Method

- By measuring these values we can calculate the Thermal Conductivity:
  - Power into metered plate
  - Area of metered plate
  - Thickness of sample
  - Temperature difference across sample

Method

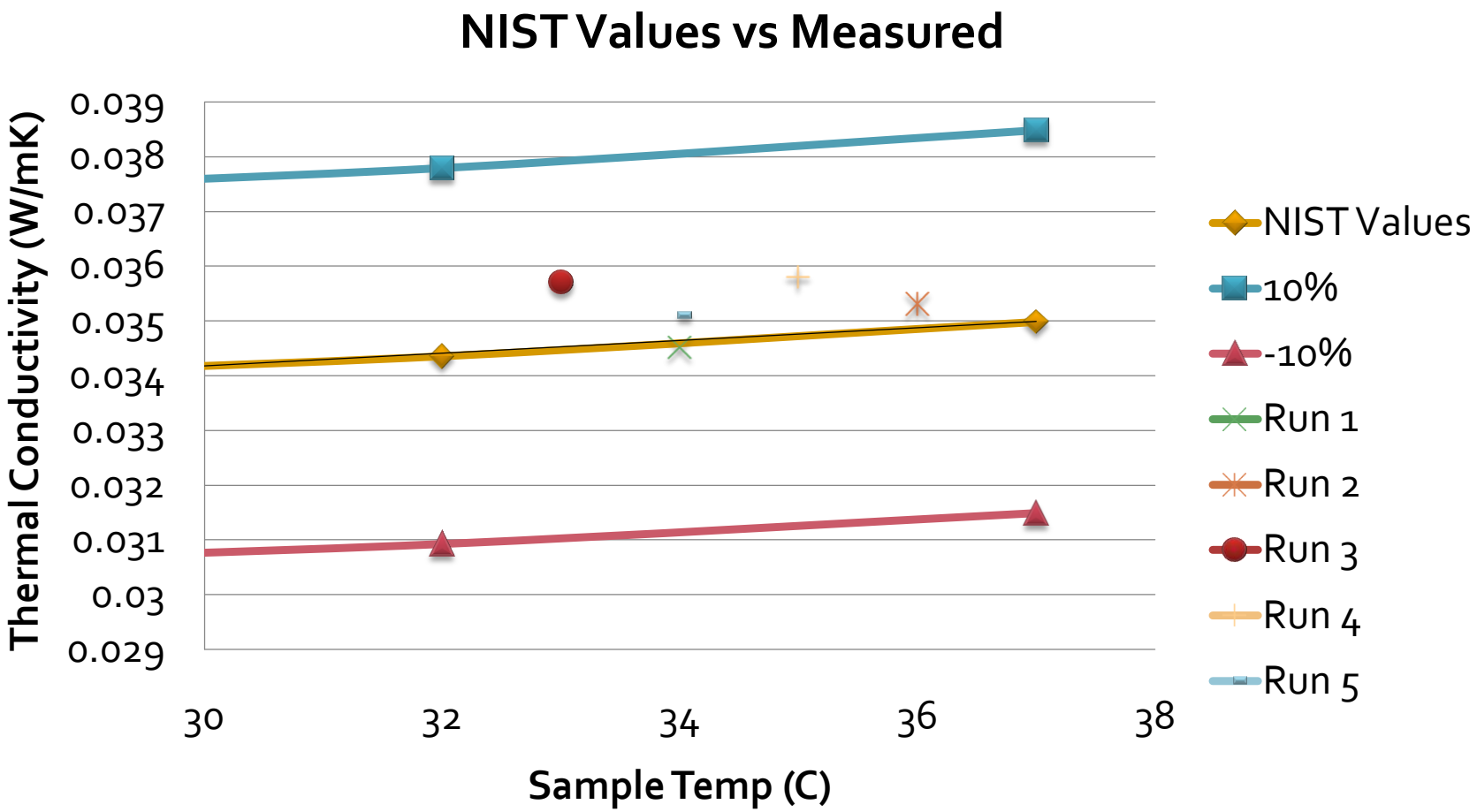
- Goal : Find Accuracy of Measured Thermal Conductivity
- Accuracy
  - The difference between the measured value and the standard value
  - Use standard material with known values from NIST (National Institute of Standards and Technology)
  - Multiple runs for more data = better results

Results

- 5 runs conducted,
  - Thermal Conductivity (k) was measured and compared to NIST values

Run	Measured k	Sample Temp	NIST k	% error	Average
1	0.0345	34	0.03475	0.719424	
2	0.0353	36	0.035	0.857143	
3	0.0357	33	0.0346	3.179191	1.66835
4	0.0358	35	0.0349	2.578797	
5	0.0351	34	0.03475	1.007194	

Results


NIST Values vs Measured
Thermal Conductivity (W/mK)
0.039
0.038
0.037
0.036
0.035
0.034
0.033
0.032
0.031
0.03
0.029
30
32
34
36
38
Sample Temp (C)
NIST Values
10%
-10%
Run 1
Run 2
Run 3
Run 4
Run 5

Summary

- Thermal Conductivity measured by Guarded Hot Plate Method
- Found Accuracy by comparing measured k to NIST values of k
- Accuracy is 1.67%
- Most available systems claim <5%

Future Work

- Test different materials
  - Accuracy might change for different materials
  - Harder to measure k for thinner samples
- Compare Accuracies
- Find Final Accuracy
  - Accuracy expected for a test and limitations

Questions?