logo

**Birzeit University**

physics 211

**Experiment No.8**

**The Thermal Expansion Coefficient of Brass**

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Student's Name: Joudeh Joudeh

student's №: *1091341*

Instructor: Dr.Nidal Dwekait

Section №: 1

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**-Abstract:**

\* The aim of the experiment:

To find the coefficient of linear expansion of a brass rod.

\* Tools :

Brass rod, mirror, 12V power supply(to heat the rod, and light the lamp), meter stick, and thermometer.

**- Theory :**

The length of a metallic rod whose length at temperature T=T0 is L0 can be found at temperature T>T0 0C by the relationship:

L(T) = L0(1+α(T-T0))

Where α is called the linear coefficient of thermal expansion.

**-procedure:**

\*step1:

1-inserting the pieces one by one between the brass rod and the mirror is started and the total thickness of the inserted papers versus the scale reading are recorded.

2- the scale reading vs. thickness inserted is plotted.

\*step 2:

1- all plastic slips are removed.

2-the length of the rod is measured.

3-turn on the heating transformer(12Va.c.).the scale reading vs. temperature is recorded .

4-turn off the heater and the same process is repeated.

**-Data:**

Initial length of the rod = 50.2 cm = 0.502 m

\*step1:

|  |  |
| --- | --- |
| Scale(cm) | T(mm)thickness |
| 13.8 | 0 |
| 14.2 | 0.1 |
| 14.6 | 0.2 |
| 15.0 | 0.3 |
| 15.4 | 0.4 |
| 15.9 | 0.5 |
| 16.3 | 0.6 |
| 16.7 | 0.7 |
| 17.1 | 0.8 |
| 17.6 | 0.9 |
| 18.4 | 1.0 |
| 18.9 | 1.1 |
| 19.3 | 1.2 |
| 19.8 | 1.3 |
| 20.2 | 1.4 |
| 21.1 | 1.5 |
| 21.6 | 1.6 |
| 22.0 | 1.7 |
| 22.5 | 1.8 |

|  |  |  |  |
| --- | --- | --- | --- |
| **T ()** | **Scale heating (cm)** | **Thickness (mm)** | **Length (cm),L(T)** |
| 30 | 14.5 | 1.6 | 50.36 |
| 35 | 14.6 | 1.9 | 50.38 |
| 40 | 14.8 | 2.2 | 50.44 |
| 45 | 15.0 | 2.6 | 50.46 |
| 50 | 15.2 | 2.9 | 50.49 |

Length vs. T

Slope = 0.0066 = L0 α

α = 0.0066/50.2 = 0.00013 0C -1

intercept = 50.16 = L0(1- α t0)

α= 0.00003 0C -1

|  |  |  |  |
| --- | --- | --- | --- |
| T () | Scale cooling (cm) | Thickness (mm) | Length (cm) |
| 45 | 14.8 | 2.2 | 50.42 |
| 40 | 14.6 | 1.9 | 50.39 |
| 35 | 14.4 | 1.6 | 50.36 |
| 30 | 14.2 | 0.8 | 50.28 |

Slope = 0.009 = L0 α

α = 0.009/50.2 = 0.00018 0C -1

Intercept=50.025=L0(1- α t0)

α = 0.00039 0C -1

αavg. = (20 ± 10 ) ×10 -6

-**Calculations:**

α= slope/L0 = 0.0066/50.2 = 0.00013 0C -1

α = = = 0.00003 0C -1 ……etc.

**-Resuult and Conclusion:**

αavg. = (20 ± 10 ) ×10 -6

α = 17× 10 -6 …………(fact value)

The coefficient α value is acceptable because the 2∆r≤∆d,

2(10 -5) ≤ 2×10 -5 then its equvelent value.This value is near the fact value so it is acceptable .

We have systematic errors when we did the experiment may be when we take the scale value or when we take the tempreture value. But we have errors in calculations.