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THERMAL CONDUCTIVITY IN METAL ROD TESTING

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Abstract *: Thermal conductivity is one of the most important Thermal property which indicates the heat transfer of the metal the aim of this study is to calculate temperature gradient and heat transfer flow rate effect on the metal from this experiment we clearly understood that in all metals conductivity is more which making suitable for heat ex changer and industrial cooling systems.*

Keywords: *Heat conduction, Thermal conductivity, Metal rod, Heat flow, Hot end, cold end, temperature gradient Temperature gradient, Free electrons, Atomic vibration, steady state, Fouriers law, cross sectional area length of rod, Temperature difference, Heat transfer rate, Good conductor, Energy transfer, Solid conduction.*

1. INTRODUCTION

Thermal conductivity in metal rod term was introduced by the mathematician and physicist Jean-Baptiste Joseph Fourier from French was published in 1822. heat transfer is the most important part of engineering which dermines the flow of heat through the metal at what speed. in metal conductivity is occur due to free electrons and lattice vibrations to choose right metal in boiler, radiator, engine. this test is very important.

2. LITERATURE REVIEW

searle designed one special type of apparatus which specially was made to measure the high conductivity of the metal. In todays date flash and steady-state methods are used to research on nano structure metals conductivity. Recent experimental work has modified metal rod tests in both contexts clasical and application driven, a Thermal conductivity measurement setup using a probe method with aluminium and carbon steel rod. recent advances focuses on, Advanced Measurement Techniques, transient methods, Steady-state methods, Novel Materials and composites, uncertainty and standardization, Temperature dependence.

3. METHODOLOGY

thermal conductivity is the property of the metal which transfers heat and temperature gradient. selection of the rod is as per the experimental setup length is minimize the heat loss. at the one end electric heater is connected which heats the rod and starts transferring heat in forward direction. and at the other copper coil is connected which is filled with water. this experiment is done for testing of metal conductivity ability.

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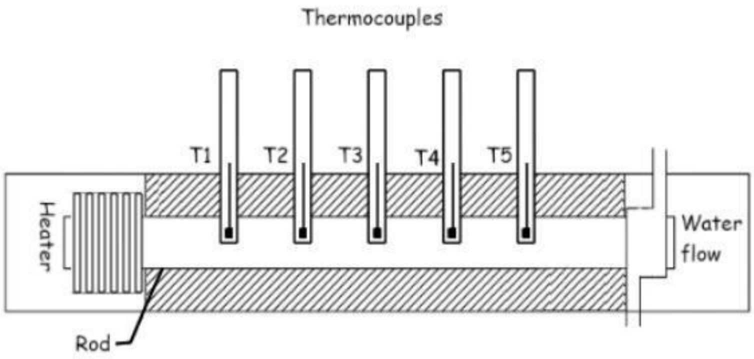

Fig.1 thermal conductivity in metal rod

Thermal conductivity can be calculated using the following equation :-
k = Q L/A (T2-T1)
where,
Rate of heat transfer(watt)k =Thermal conductivity of the material (w/m.k) A = Cross sectional area of the rod (m^2).
T1 = higher temperature
T2 = Lower temperature
L = Length of the material

Table 1 .The following table representing the thermal conductivity for different materials and its common uses

Material	Category	Thermal Conductivity (W/m·K)	Common Uses
Silver	Metal	429	Electrical contacts, high-precision heat exchangers
Copper	Metal	401	CNC-machined heat sinks, conductive structural parts
Aluminum	Metal	237	3D printed components, lightweight sheet metal parts
Brass	Metal	109	Decorative CNC or laser-cut sheet parts
Steel (Carbon)	Metal	54	Structural components machined for strength and moderate conductivity
Stainless Steel	Metal	16	CNC and sheet metal parts requiring corrosion resistance and insulation
Titanium	Metal	22	Lightweight, biocompatible parts in DMLS printing and CNC machining
ABS Plastic	Polymer	0.2	Injection-moulded prototypes and 3D-printed enclosures
Nylon	Polymer	0.25	CNC-machined and SLS-printed mechanical components
Polycarbonate (PC)	Polymer	0.19	Impact-resistant housings made via injection moulding
PEEK	High-Performance Polymer	0.25	Precision CNC parts in aerospace and medical sectors

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4. CONCLUSION

While performing this test we clearly got that the thermal conductivity of the metal is depend up on material and purity of the metal. copper has the more conductivity as compared to aluminium. the right way of understanding searle method steady-state heat flow while performing this experiment.

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