THERMAL CONDUCTIVITY APPARATUS®

OBJECTIVE
Thermal Conductivity of Liquids & Nanofluids & Engine Oils etc.

THEORY
The Apparatus follows widely accepted theory of heat conduction in liquids based on Debye's concept in which the hydroacoustic vibrations (phonons) of a continuous medium(base fluid) are responsible for the heat transfer in liquids. Based on this heat transfer mechanism, Bridgman has obtained a formula, characterized by the direct proportionality between thermal conductivity and sound velocity in pure liquids.

$$k = 3.0 \left(\frac{N}{V}\right)^{\left(\frac{2}{3}\right)} K_B v$$

where v_s = ultrasound velocity,
N (Avogadro's number) = 6.02×10^{23} and V (molar volume) $= m/\rho$
K_B = (Boltzmann's constant) = 1.3807×10^{-23} J/K

For Polyatomic Liquids it was modified as:

$$k = 2.8 \left(\frac{N}{V}\right)^{2/3} k_B v$$

For Nanofluids it was further modified by J.Hemalatha as under:

$$k_{bm} = 2.8 \left(\frac{\rho_{nf} N_A}{M_{nf}}\right)^{2/3} k_B v$$

where, k_{bm} is the thermal conductivity value obtained through the modified Bridgman equation, ρ_{nf} is the density of nanofluid, and $M_{nf} = x_{bf} M_{bf} + x_p M_p$ is the molar mass of nanofluid. x_{bf} and x_p are the molar fractions of the base fluid and nanoparticle respectively whereas M_{bf} and M_p are the respective molar masses of the base fluid and nanoparticle.

Courtesy: V.Sesha Sai Kumar
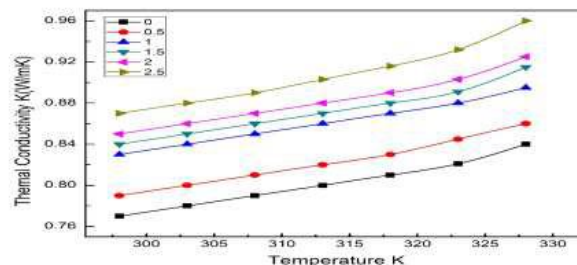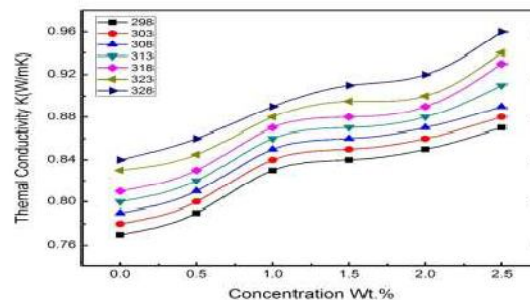
WORKING PRINCIPLE
Ultrasound waves of known frequency are produced and its wavelength is measured. Then sound velocity in Liquid

$$v = \lambda \cdot f$$

After calculating velocity of sound in Liquid, one can calculate the thermal conductivity by the formula given by P W Bridgman.

SALIENT FEATURES
1. Works upto 70°C
2. Provided with temp variation Unit.
3. Errors less than 5%
4. User Friendly

DESCRIPTION
Thermal Conductivity Apparatus consists of following parts: Electronic Unit,Conductivity Cell-2MHz,Stability Cell 4MHz to increase settling time of the suspension,Temperature Controller Unit-To maintain temp.of liquids / nanofluids at desired temp from RT to 70°C.

Manufactured By:

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