ASSIGNMENT-1 EXPERIMENT-1

1. DETERMINATION OF DIELECTRIC CONSTANT OF THE SAMPLE

AIM

To determine the dielectric constant of the given sample at different temperatures.

APPARATUS REQUIRED

The given sample, capacitance meter, dielectric sample cell, digital temperature indicator etc.

FORMULA

1. The dielectric constant of the sample is given by,

ε_r = C / C_0 (No unit)

where C = capacitance of the sample (farad)

C_0 = Capacitance of the air capacitor having the same area and thickness as the sample (farad)

2. The capacitance of air capacitor is given b

$$C_0 = \frac{\varepsilon_0 A}{d} \text{(farad)}$$

where ε_0 = permittivity of free space

= 8.854×10^{-12} farad / metre

A = area of the plates of the capacitor

($A = \pi r^2$: r = radius of the sample)

d = thickness of the sample (or) distance between the plates (m)

PRINCIPLE

The capacitance of a capacitor increases when it is filled with an insulating medium. The increase in the capacitance depends on the property of the medium, called dielectric constant (ε). It can be measured using either static or alternating electric fields. The static dielectric constant is measured with static fields or with low frequency ac fields. At higher frequencies, values of dielectric constant become frequency dependent. The dielectric constant varies with temperature also.

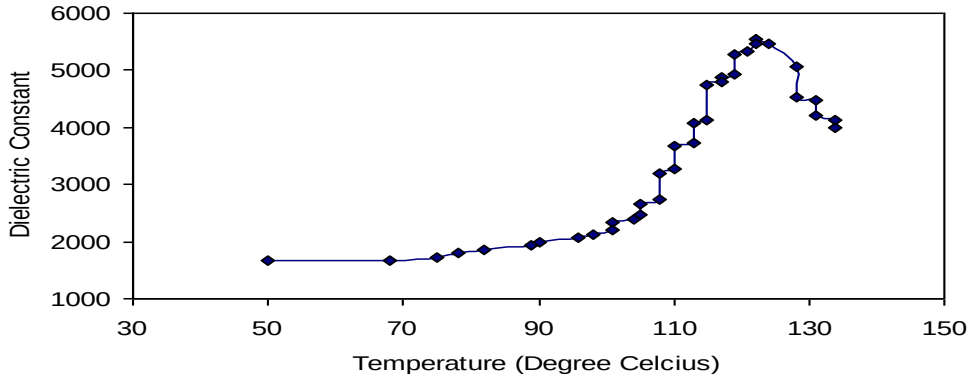

Fig. 1.1 Dielectric Constant versus Temperature for barium titanate

Table 1.1 Determination of dielectric constant of the sample

Sl.No.	Temperature (°C)	Capacitance (C) (Nano Farad)	Dielectric constant $\left(\varepsilon_r = \frac{C}{C_0}\right)$
1	35	2.97	?
2	40	3.02	?
3	45	3.08	?
4	50	3.12	?
5	55	3.16	?
6	60	3.20	?
7	65	3.25	?
8	70	3.29	?
9	75	3.33	?
10	80	3.37	?
11	85	3.41	?
12	90	3.45	?

OBSERVATION:

The radius of the sample (r) = 1 cm

The thickness of the sample (d) = 1.83 mm

Area of the capacitor plate =…… m^2

Capacitance of the air capacitor C_0 = …….. Nano farad

Assignment Question:

1. From the radius of the sample (Equal to the radius of capacitor plate) first you calculate the area of the capacitor plate by using the formula πr^2 and then calculate the capacitance of air capacitor using the formula $\varepsilon_0 A/d$. Note down the values in four decimal points in your observation note book.

2. By using the capacitance of air capacitor (C_0) and capacitance of sample (C) at various temperatures, calculate the dielectric constant ($\varepsilon_r = C / C_0$) of the sample at different temperatures and enter the values in respective coloum in the tabular coloum.

3. Draw the graph between Temperature along the X axis and Dielectric constant along the Y axis.

4. Write the result in the following order

The dielectric constants of the given sample at different temperature are measured and a graph is plotted between the temperature and dielectric constant.

Finally, submit the scanned copy of your observation note book in GCR on (or) before THREE working days from the date of experiment.