THERMAL PROPERTIES OF SILICON DOPED BORON – PHOTOACOUSTIC SPECTROSCOPY

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Introduction

The thermal properties of Silicon doped Boron is found to be different from pure silicon. The characterization of the sample has been done by FTIR and Four probe method. Thermal properties like thermal conductivity and thermal diffusivity of the sample has been calculated. PA Spectrometer is a source for data acquisition related to material science studies.

Characterization of the Sample

Fourier Transform Infrared Spectroscopy

The infrared region is calculated for the study of matter because the natural vibration frequencies of atoms in molecules fall in the IR range. Spectroscopy is the necessary technique for chemical identification and analysis. After absorption of IR Radiation, the molecules vibrate giving rise to close packed absorption bands called IR absorption spectrum. The Interferogram can be made to yield the Spectrum as a function of frequency by the mathematical procedure known as Fourier transform. An interferometer and digital computers can be combined to produce the spectrum.

FTIR Spectrum of Silicon doped Boron

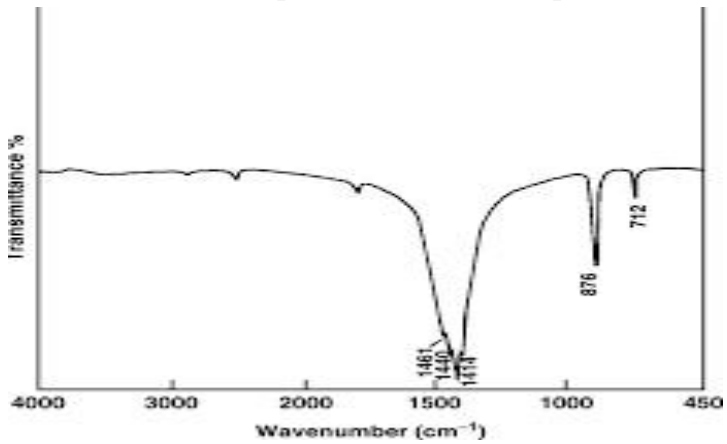

Figure 1

Four Probe Method

This method is used to determine the resistivity of silicon. The set up for the measurement is as shown in Figure 2.

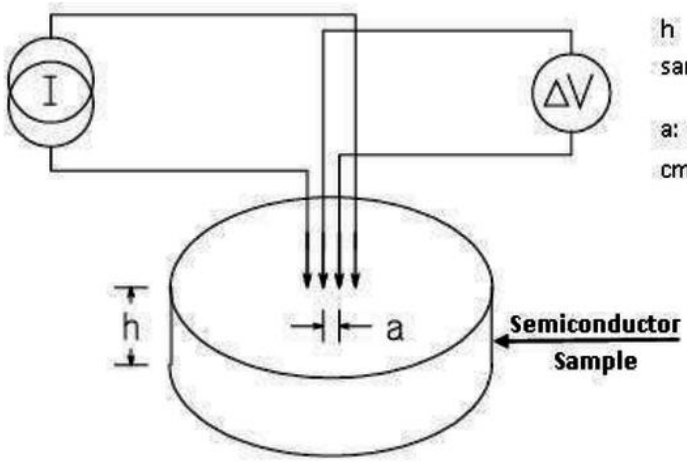

Figure 2

Observation

Table:1 Current I = 3 mA

S. No.	Temp in ^{0}C	Voltage in mV	Temp in K	ρ_0 (ohm – cm)	ρ (ohm – cm)
1	40	89.2	313	37.34	4.71
2	45	82.5	318	34.54	4.36
3	50	76.4	323	31.98	4.03
4	55	70.6	328	29.55	3.73
5	60	65.4	333	27.38	3.46
6	65	61.8	338	25.87	3.26
7	70	52.2	343	21.85	2.75
8	75	46.4	348	19.42	2.45

PA Spectrometer

This method is becoming prominent within industry and science. The Experimental setup is as shown in Figure 3.

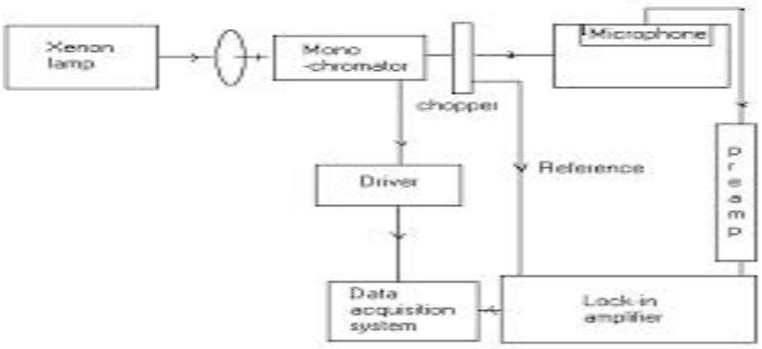

Figure 3

S. No.	Frequency	PA Amplitude
1	20	4.5
2	25	4.2
3	30	3.9
4	35	3.6
5	50	3.3
6	55	3.2
7	60	3.1
8	65	2.9
9	70	2.8
10	80	2.6

Thermal Diffusivity and thermal conductivity of silicon and silicon doped Boron were calculated.

Sample	Thermal Diffusivity	Thermal conductivity
Silicon doped Boron	0.091	0.27
Silicon	0.8	1.48

Results and Discussion

The thermal properties of Silicon doped Boron and Silicon were studied. Thermal properties like thermal conductivity and thermal diffusivity of the sample have been calculated. The value decreases drastically in a doped sample compared to crystalline silicon. Therefore the doped silicon can be used as a better thermal insulator.

References

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