Band structure and electrical conductivity in semiconductors

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1 Abstract

In this experiment, we will measure the temperature dependent electrical conductivity for the semiconductor samples (unijunction transistor, Ge).

2 Introduction

Here you have to define the subject of the report, also give brief summary and purpose of the experiment.

You do not have to follow the sectioning advised in this document.

3 Theoretical background

The electrical resistivity of a semiconductor lies between a conductor and an insulator [1] (**this is how you will cite a reference**). In conductors, current is carried by electrons, whereas in semiconductors, current is carried by the flow of electrons or positively charged holes.

The total electrical conductivity is the sum of the conductivities of the valence and conduction band carriers, which are holes and electrons, respectively. It can be expressed as (**see how will you write an equation**),

$$\sigma = n_e q_e \mu_e + n_h q_h \mu_h, \tag{1}$$

where n_e, q_e, and μ_e are the electron's concentration, charge and mobility, and n_h, q_h, and μ_h are the hole's concentration, charge and mobility, respectively. In the intrinsic region the number of electrons is equal to the number of holes [2], so Equation (1) (**this is how you will refer an equation**) implies that,

$$\sigma \;=\; n_e q_e(\mu_e + \mu_h). \tag{2}$$

There are two important quantities introduced in the above expression: $g(E)$ is the number of states per unit energy per unit volume known as the density of sates. The density of states in the conduction band can be derived from first principle and is given by,

$$g(E) \;=\; \frac{(\sqrt{2})m_e^{*3/2}}{\pi^2\hbar^3}\left(E - E_c\right)^{1/2}. \tag{3}$$

The scatterer mean time τ_L due to lattice vibrations will become (**see how will you separate an equation into parts**),

$$\tau_L \;=\; \frac{1}{Sv_{th}} \propto \frac{1}{T^{3/2}} \tag{4}$$

$$\;=\; T^{-3/2}. \tag{5}$$

See how will you divide a section into subsections.

3.1 Intrinsic semiconductors

Intrinsic semiconductors are those having no impurities.

3.2 Extrinsic semiconductors

An extrinsic semiconductor is in which doping has been introduced to change the number and type of charge carriers.

4 Experimental procedure

May be, you like to include an enumerated list. This is how you can achieve this.

1. Assemble the setup as shown in Figure (1) (**this is how you refer to Figures in the text**).

   Note: Figure should be in the 'eps' format and must be in the same folder in which you have saved your Latex file.

   See how will you add a figure.

2. Make the circuits for constant current source of 10 mA and voltmeter on the bread board.

   Note: Units must be out of math mode. Numeric values and symbols should be in math mode.

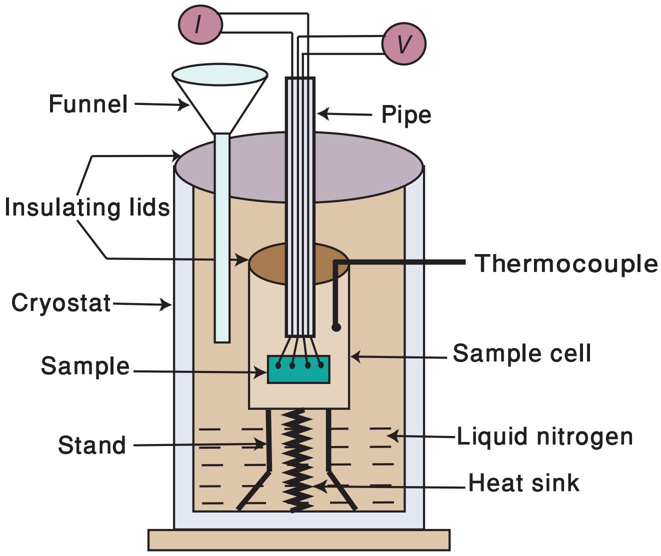

Figure 1: Experimental setup.

5 Results

Here you will write down the results of the experiment. For example, tabulate temperature versus resistance as indicted in Table (1) (**see how you refer and include a table**).

Temperature (°C)	Resistance (Ω)
−150	
−140	
.	
.	
250	

Table 1: Relationship between temperature and sample resistance.

6 Conclusions and discussion

Here you will write down the conclusion, and discuss your experiment in detail. This is very critical part.

See how will you add references in the Latex file.

References

[1] C. Kittel, "*Introduction to Solid State Physics*", John Wiley and Sons, (2005), pp. 216-226.

[2] A. Sconza and G. Torzo, "*An undergratuduate laboratory experiment for measuring the energy gap in semiconductors*", Eur. J. Phys. 10 (1989).

To get more knowledge of the LaTeX, please visit the following web sites.

References

[1] http://www-hermes.desy.de/latex/ltx-2.html.

[2] http://www.tug.org/tutorials/latex2e/.

[3] http://www.artofproblemsolving.com/Wiki/index.php/LaTeX:Commands.

[4] http://en.wikibooks.org/wiki/LaTeX/Command Glossary.