



Structural and Electrical Properties of Intrinsic Semiconductors

- Puja Kumari • Kajal Kumari • Alka Kumari
- Rohit Singh

Received : November 2019

Accepted : March 2020

Corresponding Author : Rohit Singh

Abstract: The paper reports on the structural and electrical properties of intrinsic semiconductor crystals such as Si and Ge. These semiconductors crystallize in diamond cubic structure. The lattice constants of the Silicon semiconductors are $a = b = c = 5.44 \text{ \AA}$, $\alpha = \beta = \gamma = 90^\circ$ and the lattice constants of Germanium semiconductors $a = b = c = 5.6 \text{ \AA}$, $\alpha = \beta = \gamma = 90^\circ$. The crystallite sizes of the Silicon and Germanium crystal for the (111) peak are observed to be about 455 Å and 273 Å respectively. The resistivity versus temperature measurement of Germanium crystal was also performed by four probe method. The room temperature resistivity of Germanium semiconductor is $\sim 6.5 \text{ } \Omega \text{-cm}$ and above 300, its value

decreases. At 420 K, resistivity drops to $\sim 1 \text{ } \Omega\text{-cm}$. The band gap of germanium crystal is also calculated by plotting $\log \rho$ versus T^{-1} . The Ge semiconductor has 0.69 eV band gap at room temperature.

Keywords: Silicon, Germanium, Semiconductor, Band gap, Diamond cubic structure.

Introduction:

There are a large number of materials which are having resistivity between those of an insulator and a conductor such materials are known as semiconductors.

Properties of Semiconductors:

1. Pure and perfect crystal of most of the semiconductors is non-conducting at absolute zero.
2. Resistivity of any semiconductor is a function of temperature and decreases with the rise in temperature.
3. Their resistivity lies in the range of 10^2 to 10^9 ohm-cm at room temperature and is thus intermediate between the resistivity of a good conductor (10^{-6} ohm-cm) and an insulator (10^{11} to 10^{22} ohm-cm).

Puja Kumari

B.Sc. III year, Physics (Hons.), Session: 2017-2020,
Patna Women's College, Patna University, Patna,
Bihar, India

Kajal Kumari

B.Sc. III year, Physics (Hons.), Session: 2017-2020,
Patna Women's College, Patna University, Patna,
Bihar, India

Alka Kumari

B.Sc. III year, Physics (Hons.), Session: 2017-2020,
Patna Women's College, Patna University, Patna,
Bihar, India

Rohit Singh

Asst. Prof., Department of Physics,
Patna Women's College, Bailey Road,
Patna-800 001, Bihar, India
E-mail : rohit.phy@patnawomenscollege.in