

Semiconductor Diodes

Friends now I'm going to discuss about the topic semiconductor diodes. We already know that diodes are playing an important role in our electronics life. We are using them in so many ways.

The symbol of a Diode is as follows:

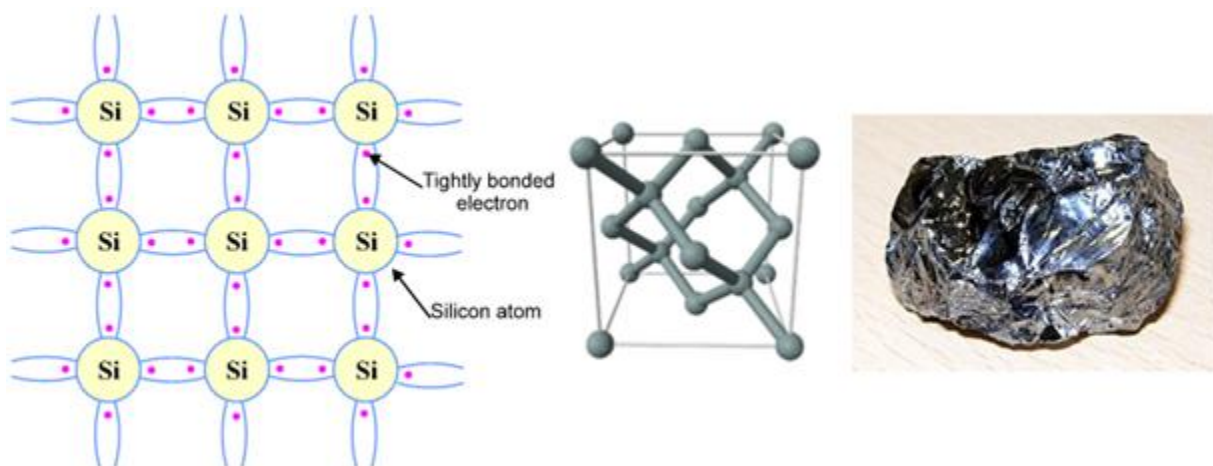


Before entering into the topic, we have to know about the semiconductors. Semiconductor is a material which is neither insulator nor a conductor. It varies based on the temperature conditions surrounded.

Coming to the discussion about the intrinsic semi conductors, semiconductor in its purest form is called intrinsic semiconductor. Basically we use the germanium, silicon materials as semiconductor materials. We already know that most of the devices are manufactured with the silicon material only due to its abrupt properties and material availability in nature.

Now to understand about the topic of diode working, we have to know about the small topics named crystal structure of semiconductors and conduction by electrons and holes.

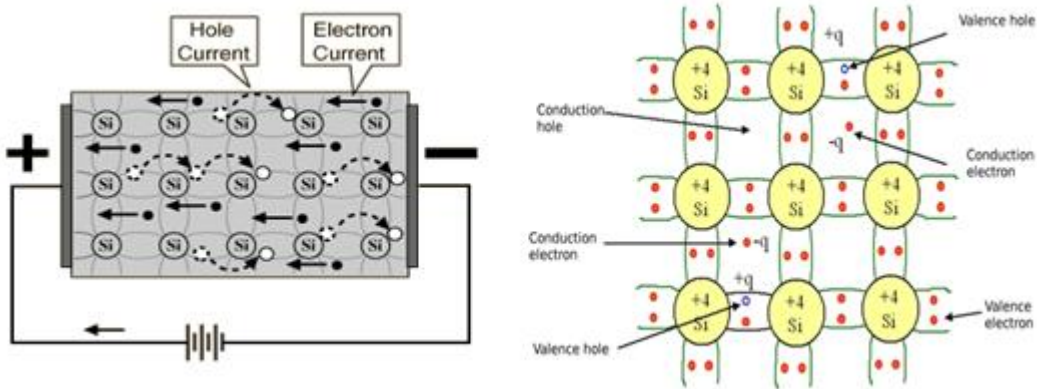
Crystal Structure of Intrinsic Semiconductor: Observe the picture. It is a silicon intrinsic semiconductor material. An outer most shell of an atom is capable of holding eight electrons. It is said to be completely filled and stable, if it consists eight electrons. But outer most shell of an intrinsic semiconductor like silicon has only 4 electrons. Each of these electrons forms a bond with another valance electron of neighbor atoms. These bonds are called covalent bonds. These atoms themselves aligned to form a pattern called crystal.



By giving external energy (heat), the electrons will come out from the bonds and pattern will become unstable implies to flow of current through it. At zero temperature, we can observe that all the electrons bound in their positions only. Hence such an intrinsic semi conductor behaves as a perfect insulator at zero temperature.

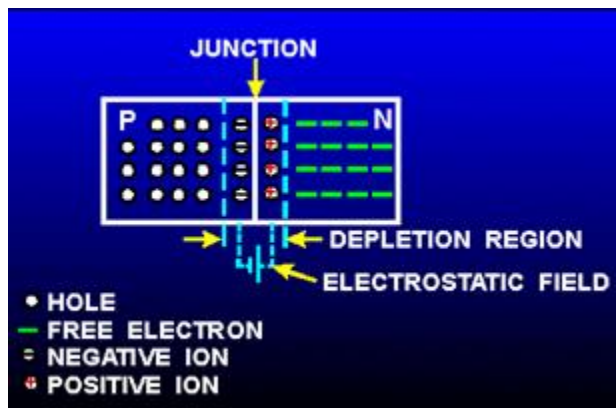
So from this discussion we got that the electrons and holes are the charge carriers in semiconductors. An electron is a negatively charged particle and a hole is a particle due to the electron drift.

Conduction of Electrons and Holes: The electrons and holes generate due to thermal generation move randomly and hence can not constitute any current. Now consider a battery connected across the intrinsic semiconductor. Under the influence of applied voltage, here is electron and hole motion in particular direction. As there is availability of electrons and also holes, the electrons try to fill the holes, in the way due to this process some energy also flows.



Conduction in Intrinsic Semiconductors: Let us now consider that a battery is connected across an intrinsic semiconductor. The free electrons negatively charged experience towards the positive terminal of the battery while the holes as positively charged experience a force towards negative terminal of battery.

Discussion About P-N Junction: In semiconductor physics, we can observe that in n-type the electrons are majority charge carriers and holes are minority charge carriers. In p-type the holes are majority and electrons are minority. These two types of materials namely n-type and p-type are chemically combined with a special fabrication technique to form p-n junction. Such a semiconductor p-n junction forms a popular electronic device called Diode.



Source: <http://www.electronicshub.org/semiconductor-diodes/>