

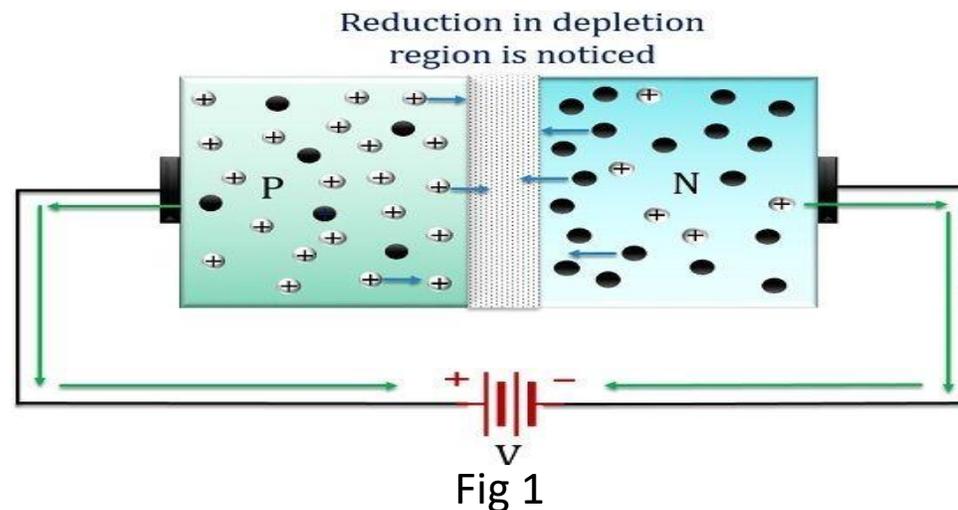
# Semiconductor

## Lecture 3

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## Forward Biased Condition:

At forward biased condition,  $p$  –  $side$  of the device is connected with positive terminal of the supply. The  $n$  –  $side$  is connected with negative terminal. Therefore the junction is said to be in forward biased. When forward biasing is applied the holes in the  $p$  –  $side$  experience repulsive force from the positive terminal. Similarly  $n$  –  $side$  also experience a repulsive force from the negative terminal of the supply provided.



However initially the majority charge carrier from both sides do not move across the junction due to barrier potential. When barrier potential exceeded the majority charge carrier starts to move across the junction. This movement of charge carriers after overcoming the barrier potential generates current. This current is known as majority current. At the moment the barrier potential is removed the resistance offered by the junction becomes zero. Now a forward current starts to flow through the device. The barrier potential for  $Si$  is  $0.7\text{ v}$  and for  $Ge$  it is equal to  $0.3\text{ v}$ . So after overcoming the respective potential in case of both the materials, forward current starts flowing through the device.

## Reverse Biased Condition:

When we externally provide the potential to the device in such a way that  $p$  –  $side$  is connected to the negative terminal of the supply and  $n$  –  $side$  is connected with the positive terminal. Then the device is said to be in reverse biased. When a reverse potential is applied the holes from the  $p$ -side experience attraction from the negative terminal of the supply provided.

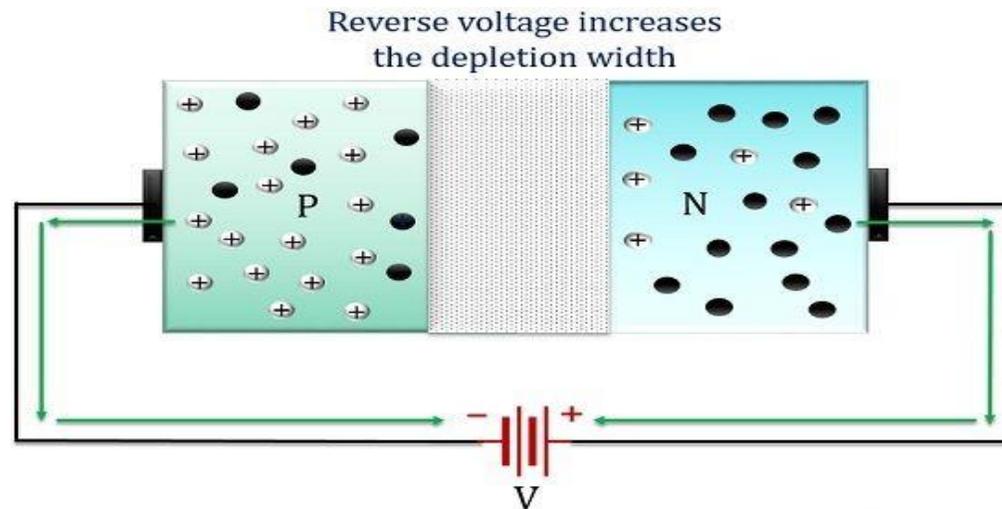


Fig 2

Due to this the majority carrier present in both side move in the direction away from the junction. This broadens the width of the depletion region and the potential barrier increased. This makes the device in nonconducting state. However due to minority carrier present in both *p & n side* a very small current flows. This small current in the device is known as leakage current. This reverse current is independent of barrier potential and depends only on temperature and construction of device.

### **Characteristic Curve of Diode:**

As shown in Fig 13 region A represents the curve for forward biased diode and region B represents the curve for the reverse biased diode.

Let us consider that the diode is made of silicon material. Hence the external potential is required to overcome the barrier potential is  $0.7\text{ v}$  . Thus it is seen in forward bias region a rapid increase current is noticed after  $0.7\text{ v}$  . This is known as knee voltage after which the barrier potential is totally removed and the device starts to conduct.

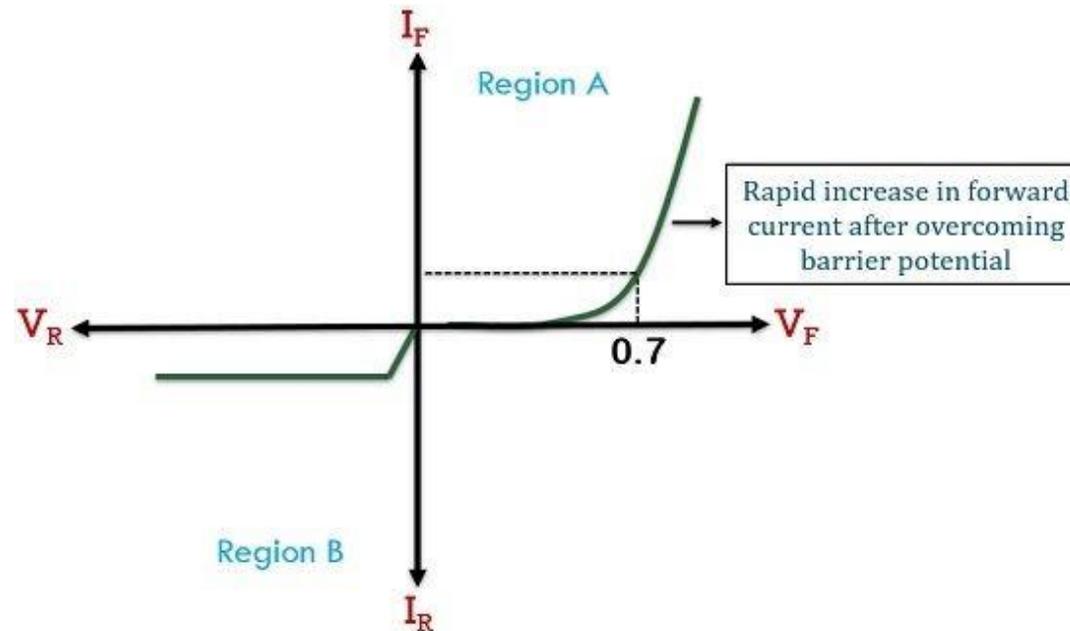


Fig 3

On the other hand region B represents the reverse bias condition of the device. In this case the width of the depletion region is very large as well as the barrier potential. Thus the curve represents the reverse saturation current that flows only due to movement of minority charge carrier through the device. For Si it is equal to less than  $1\mu amp$  .

It is noted that at a nominal reverse voltage a small reverse current flows. But on increasing the reverse voltage a condition arises that causes the junction of the diode to break down. This causes an immediate increase in the reverse current through it.