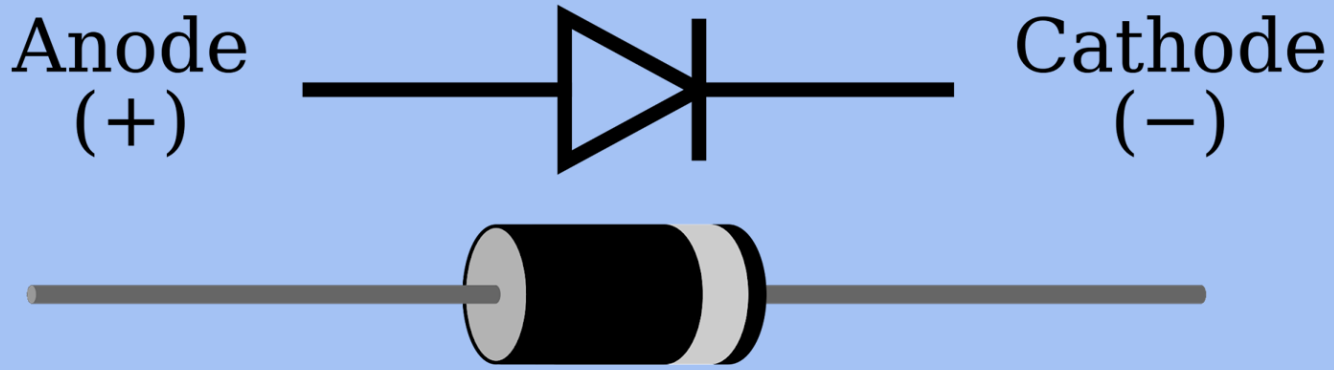
SUBJECT: BASIC ELECTRONICS

Semiconductor Diode: Formation

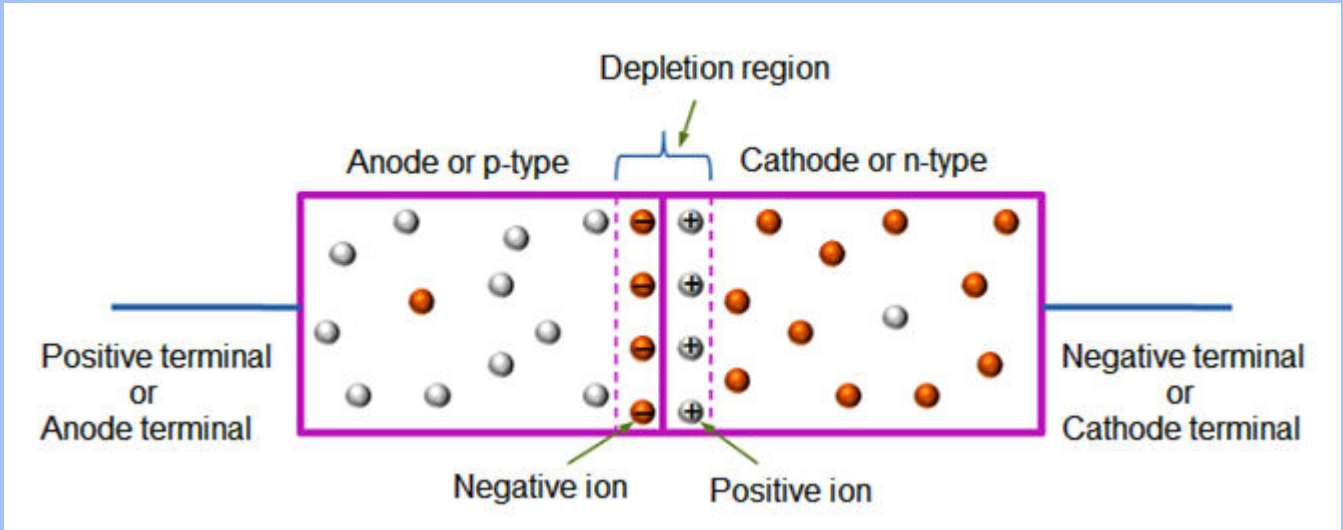
Elementrix Classes

Introduction

- A semiconductor pn junction diode is a two-terminal electronic component that is formed by joining a p-type semiconductor material with an n-type semiconductor material. The term "pn junction" refers to the interface or junction between these two types of semiconductors.



Formation of P-N Junction Diode



Here's what happens in a p-n junction, step-by-step:

- **Doping:**

  The p-type region has extra holes due to doping with elements like boron.

  The n-type region has extra electrons due to doping with elements like phosphorus.

- **Diffusion:**

  Electrons in the n-type region diffuse across the junction to the p-type region because there are fewer electrons there.

  Holes in the p-type region diffuse across the junction to the n-type region because there are fewer holes there.

- **Recombination:**

  When an electron from the n-type region meets a hole in the p-type region,resulting in a neutralizing effect.

  The excess electron in the n-type region disappears, leaving behind a positively charged donor atom that is fixed(immobile) in place.

  The excess hole in the p-type region disappears, leaving behind a negatively charged acceptor atom that is fixed(immobile) in place.

- **Charge Distribution After Recombination:**

  Therefore, the charge distribution near the junction is as follows:

  In the n-type region near the junction: Accumulation of positive charge due to the ionized donor atoms that donated electrons.

  In the p-type region near the junction: Accumulation of negative charge due to the ionized acceptor atoms that accepted electrons.

❑ **Depletion Region and Potential Barrier:**

The charge distribution after recombination in a semiconductor junction results in the formation of a depletion region. This region, marked by an accumulation of positive charge in the n-type region and negative charge in the p-type region near the junction, establishes an electric field. The depletion region acts as a barrier to the further diffusion of charge carriers, creating a separation of charges and contributing to the development of a built-in potential across the junction.

Currents in a PN-Junction Diode

- **Diffusion Current:** Diffusion current is caused by a concentration gradient, resulting in the net movement of carriers from areas of higher concentration to areas of lower concentration due to their random thermal motion.

- **Drift Current:** Drift current is caused by an electric field, leading to a net motion of carriers in response to applied voltage or built-in potentials in semiconductor devices.

पढ़िए और पढ़ाइये

SUBSCRIBE, SHARE, COMMENT