

# PN JUNCTION ENERGY STORAGE



What is a PN junction? A PN junction has rectifying current-voltage ( $I$ - $V$  or  $V$ - $I$ ) characteristics as shown in Fig. 4-2. As a device, it is called a rectifier or a diode. The PN junction is the basic structure of solar cell, light-emitting diode, and diode laser, and is present in all types of transistors. In addition, PN junction is a vehicle for studying the theory



How can a PN junction be fabricated? As illustrated in Fig. 4-1, a PN junction can be fabricated by implanting or diffusing (see Section 3.5) donors into a P-type substrate such that a layer of semiconductor is converted into N type. Converting a layer of an N-type semiconductor into P type with acceptors would also create a PN junction.



What devices are based on the PN junction? Several other useful and even more interesting devices are also based on the PN junction. They are all optoelectronic devices. The first is the solar cell. Commonly made of silicon, solar cells, also known as photovoltaic cells, can convert sunlight to electricity with 15 to 30% energy efficiency.



What is a p-n junction BIEF? The p-n junction BIEF has a reversibly changed field direction and provides extra inside coulombic force to boost the  $\text{NH}_4^+$  diffusion kinetics, resulting in outstanding capacity of 838.56 Fg<sup>-1</sup> (186.35 mAh g<sup>-1</sup>) at 1 Ag<sup>-1</sup> in 0.5M  $\text{NH}_4\text{Ac}$ , which simultaneously outperforms than those in metallic cation electrolyte due to the existed H-bond.



How a photon is generated in a PN junction recombine? Photons are generated when the electrons and holes injected by the PN junction recombine. and a hole recombine. The photon generation process, called radiative recombination, is straightforward and fast in direct-gap semiconductors with nanosecond lifetime.

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What is an idealized pn junction? For simplicity, it is usually assumed that the P and N layers are uniformly doped at acceptor density  $N_A$  and donor density  $N_D$ , respectively.<sup>1</sup> This idealized PN junction is known as a step junction or an abrupt junction. Let us construct a rough energy band diagram for a PN junction at equilibrium or zero bias voltage.



In the previous section, we have discussed the diffusion potential across a pn junction. You now understand that the Fermi level is the reference energy level for the pn junction. In the case of a metal-semiconductor junction, ???



This work designs a PN-like junction structure by introducing Ag<sub>2</sub>O nanoparticles into lead-free 0.92K<sub>0.5</sub>Na<sub>0.5</sub>NbO<sub>3</sub>-0.08BiMnO<sub>3</sub> solid solution films to investigate the role of PN-like junction effects in energy storage ???



5.2 Energy-Band Diagram of PN Junction. The potential energy of an electron is given by  $(E = -e\phi)$ , meaning electron energy varies as potential varies across the depletion region. This is as if there is storage of charge, ???



The application of voltage (i.e., an electric field) across the junction also causes drift current to flow. However, the diffusion current is dominant except in a depletion region. When the pn junction is unbiased, current stops flowing ???



Figure (PageIndex{4}) shows the energy level diagram for a reversed biased pn junction. For a reverse biased pn junction, the voltage across the junction ( $V_0 + V_x$ ) is larger than for an unbiased junction, and the energy needed for ???