

What is Solar Power?!

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2 Forms of Solar Power

The two forms of electric power are:

- A. Passive Solar – as in solar hot water, or passive solar air heating.
- B. Solar Electric or Photovoltaics – as in solar cells.

Passive Solar is the more simple of the two forms – making use only of the longest, infrared wavelengths of light. This wastes the largest percent of energy of sunlight – all the visible light. That is why it is worth putting energy into creating solar electric cells. However passive solar, such as water heating and heating of air is very cheap compared to solar electric, therefore, it is still a valuable source of energy.

Solar Electric or Photovoltaic Power is the subject of this pamphlet. First we must look at the basic building blocks of matter, electrical properties of materials, specifically semiconductor materials, and what electricity is.

Basic Building Blocks of Solid Matter

Matter is composed of three basic fundamental types of building blocks (and these are composed in turn, of many smaller particles, but this is beyond the scope of this talk.)

- Proton – positively charged particle (held in the center or nucleus of the atom)
- Electron – negatively charged particle (moves at a comparative great distance from the center or nucleus of the atom)
- Neutron – non charged particle (held in the center or nucleus of the atom)

What makes each element unique is the number of each of these blocks it has.

Today we will discuss electron properties of matter.

Electrons are held in shells around the nucleus of the atoms, and the number of electrons and whether the shells are full determines whether the atom will want to accept an electron or give it up, or share it with other atoms.

Materials Basics

It is the properties of the shells of electrons in atoms that are very important to the electrical properties of materials.

There are 3 Classes of Electrical properties in solid materials:

- A. Conductors
- B. Insulators
- C. Semiconductors

In Conductors, the electrons are held less tightly by the nucleus of the atoms.

This is because there are electrons in shells at a distance from the nucleus that aren't full. This allows them to easily move in clouds or wave along the material.

In Insulators, the electrons are held tightly to the nucleus of the atoms, so that they cannot be pulled away.

In Semiconductors the electrons are in insulation and conduction bands, with a gap between them defined by the specific material. This gap is also defined by an energy division – that is the energy that is taken to move the electron far enough away from the atom for it to reach the conduction band.

Semiconductors

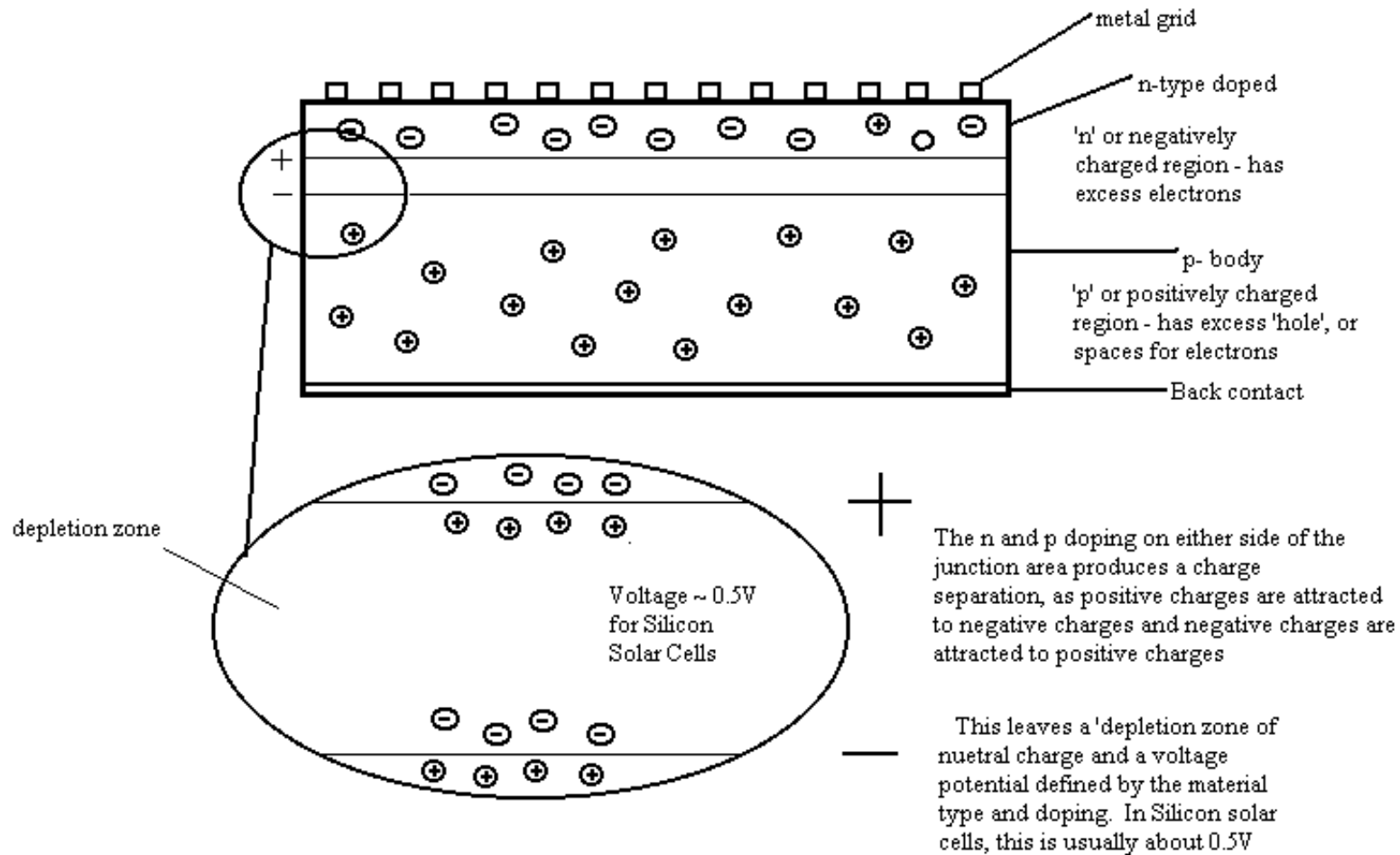
Semiconductors are used for solar cells. This band gap allows one to harness the energy of light, because light is made of photons – little packages of energy, which can be used by the electrons.

There are 3 kinds of Semiconductors:

- A. Intrinsic – non-doped semiconducting element
- B. N-type – doped with another element to give more electrons – usually - phosphorus
- C. P-type – another element to give less electrons (or more “holes”, or protons) – usually boron

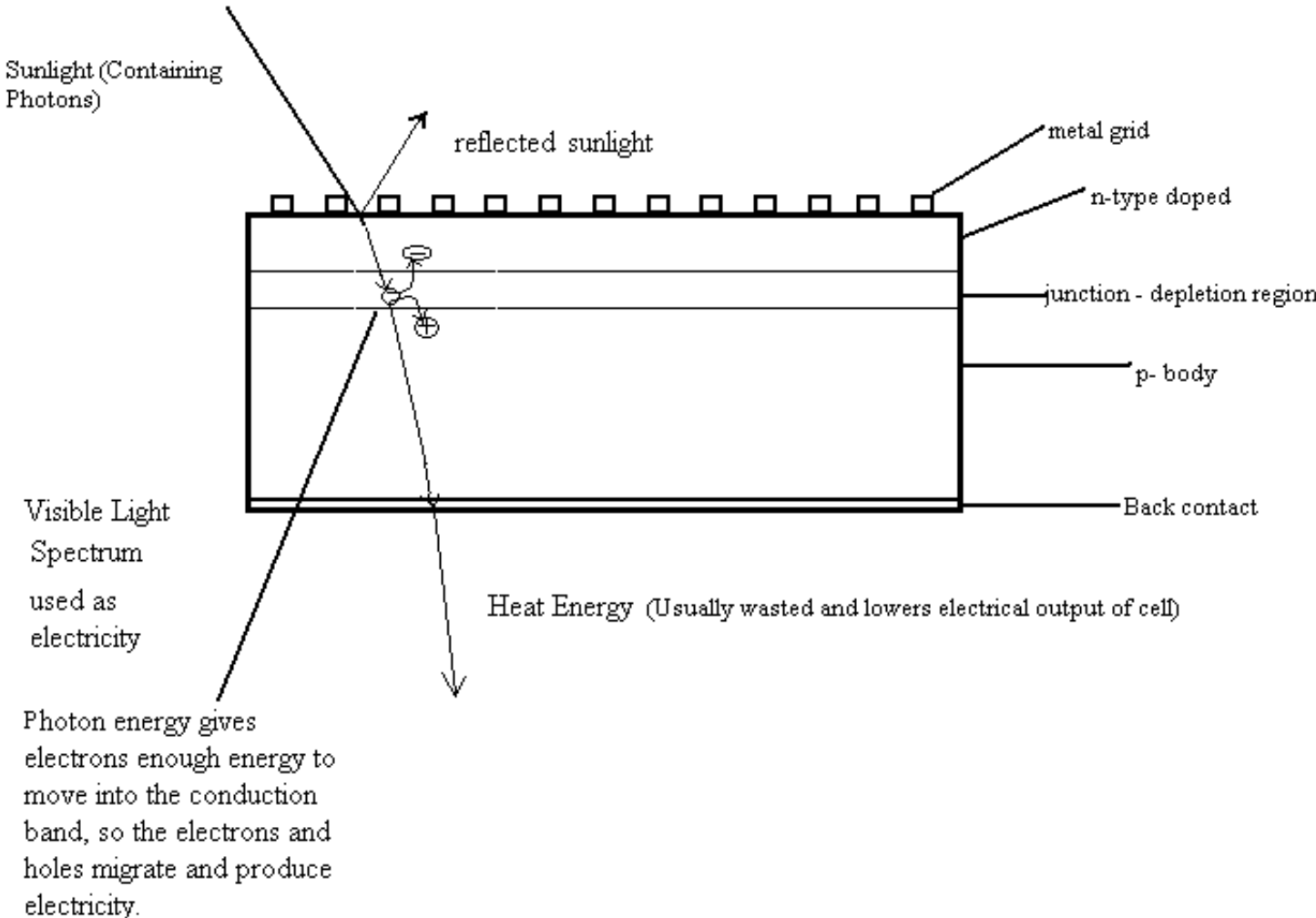
In making a solar cell, an intrinsic semiconductor is usually doped with other elements in layers, to create an electric potential between the electron doping layers. The purpose is to create an area where these energized electrons can be pulled towards a conductor and captured as electricity.

The Basic Solar Electric Cell



The Basic Solar Electric Cell

Basic Solar Cell Under Sunlight



The Basic Solar Electric Cell

Basic Solar Cell Under Sunlight in an electrical circuit

