PHOTOVOLTAIC CELL

Nisha C D
Asst Professor
Dept of Computer Science
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photo-voltaic cell is an energy harvesting device, that converts sol
nergy into electricity through a process called the photovoltaic eff

he photovoltaic effect is a process of generating electrical voltage o
lectric current from a photovoltaic cell when it is exposed to sunlig

onstruction

hotovoltaic cell consists of many layers of materials.

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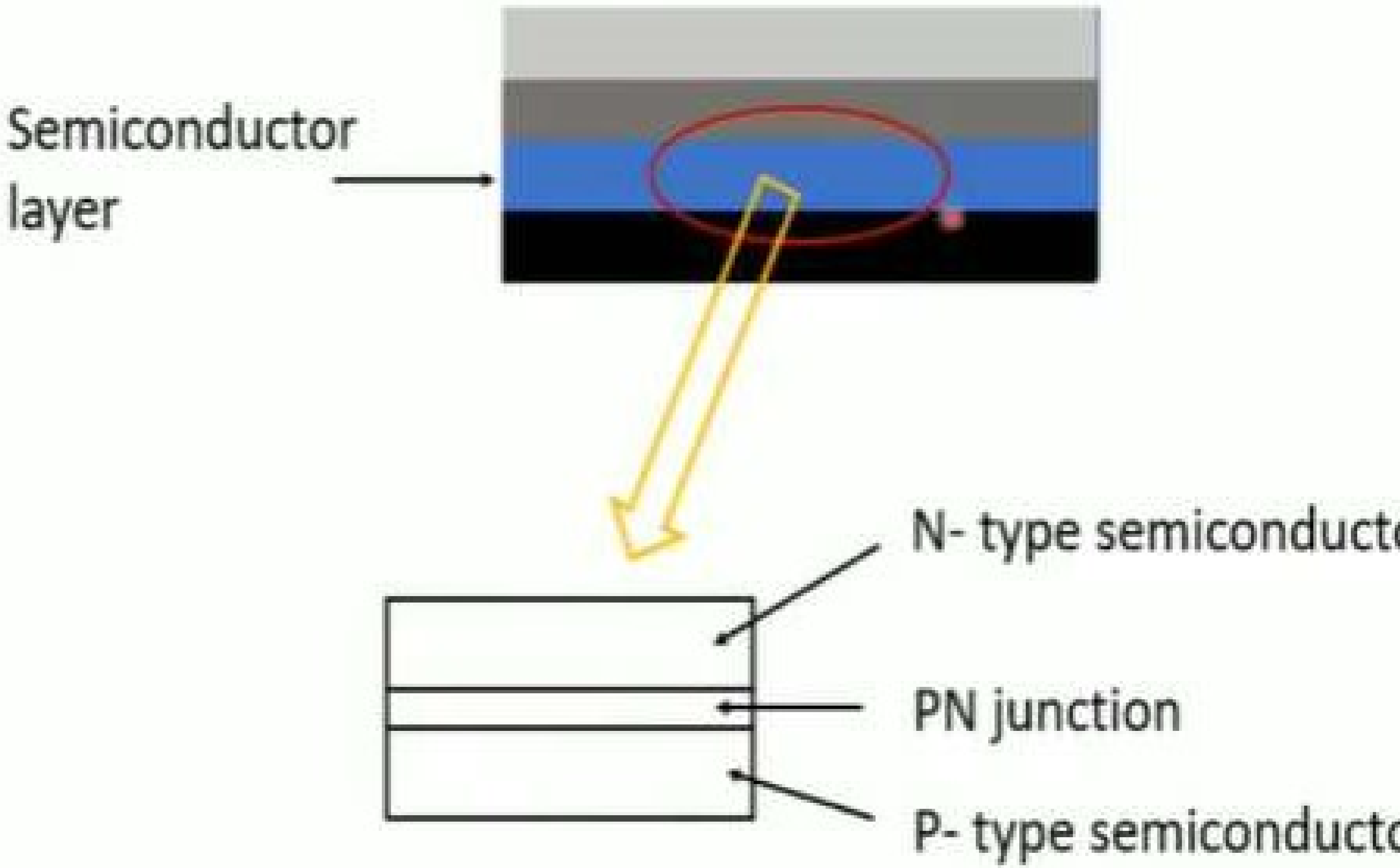
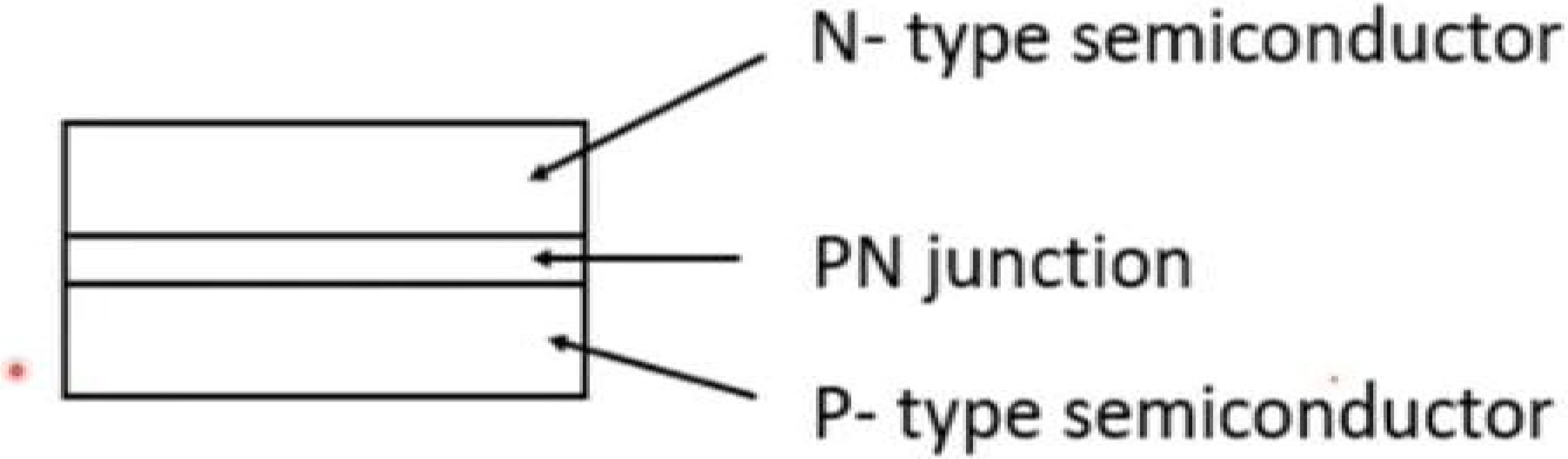
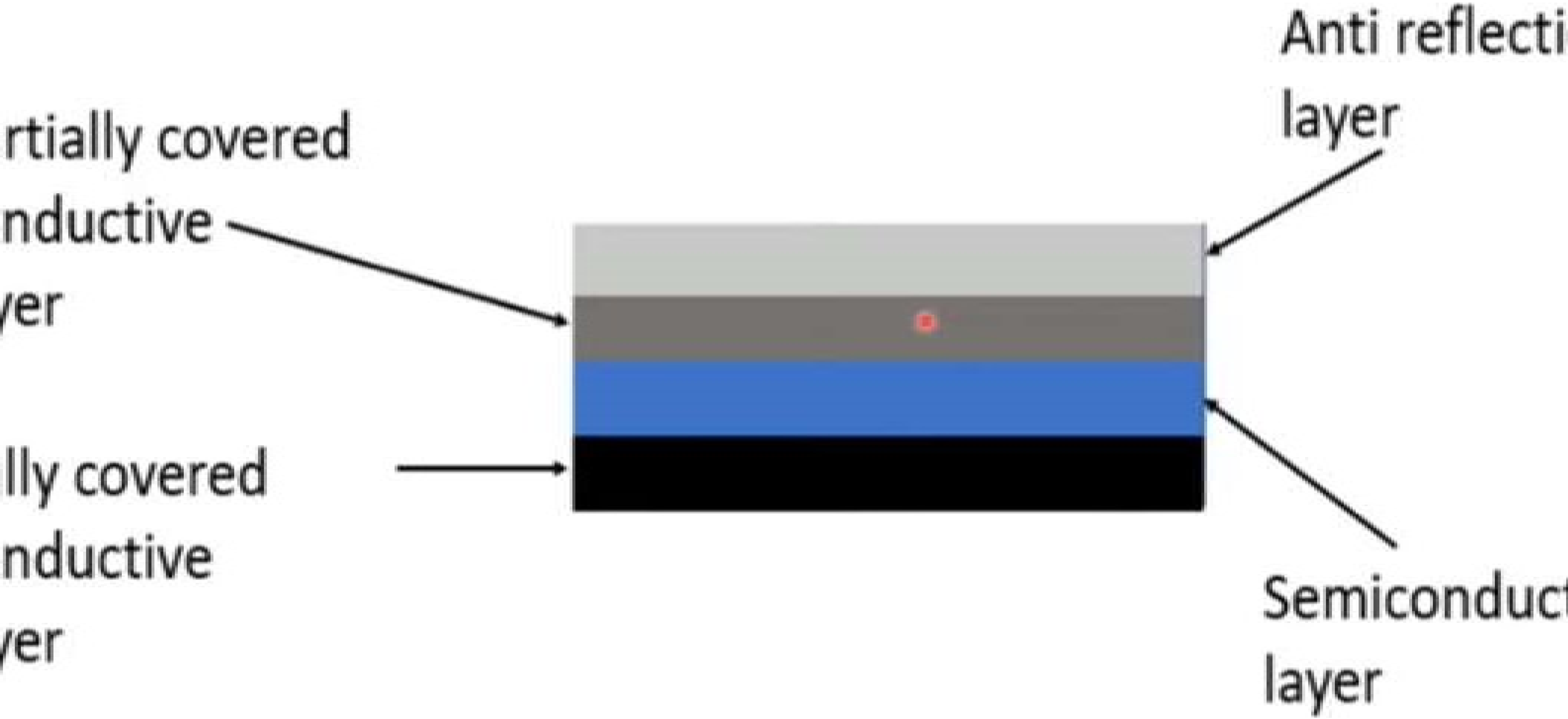


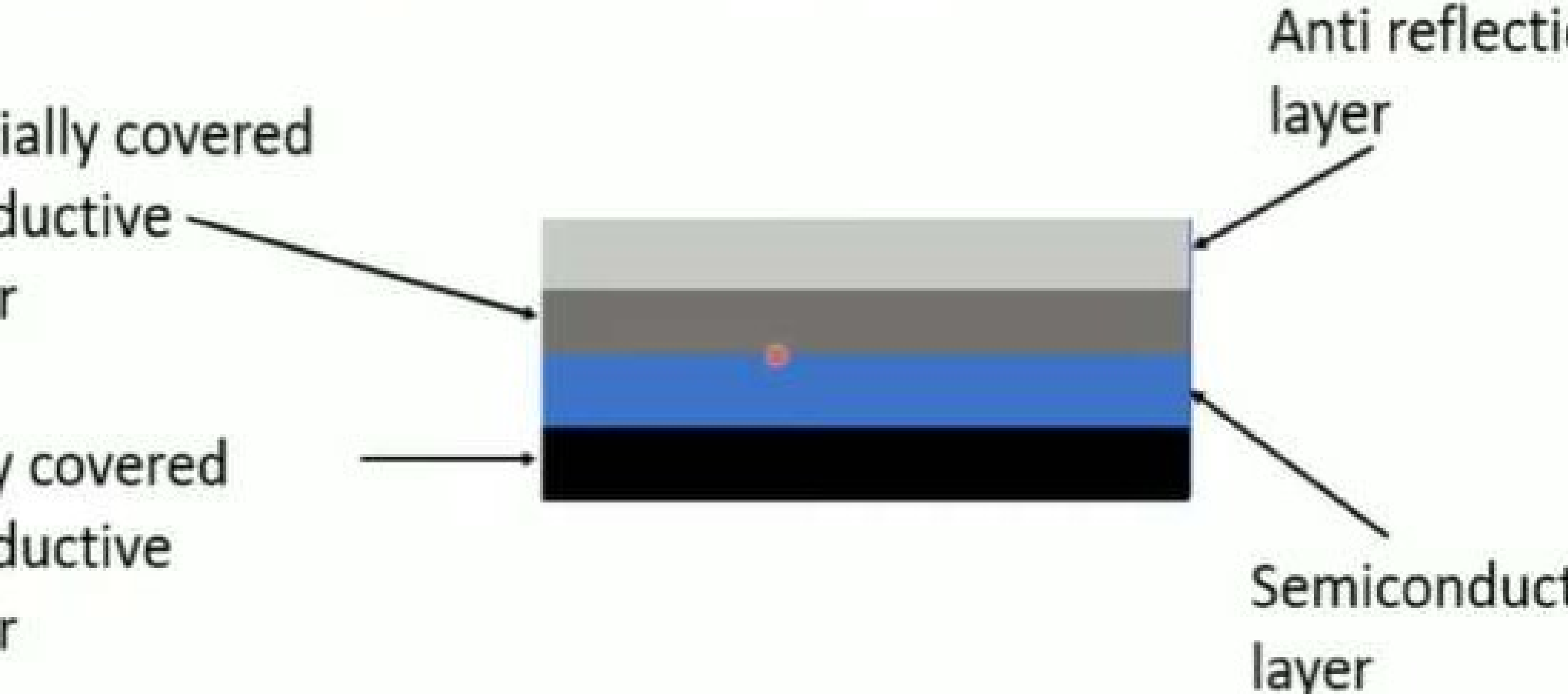
he semiconductor layer is comprised of two distinct layers of p-type and n-ty
emiconductor materials.



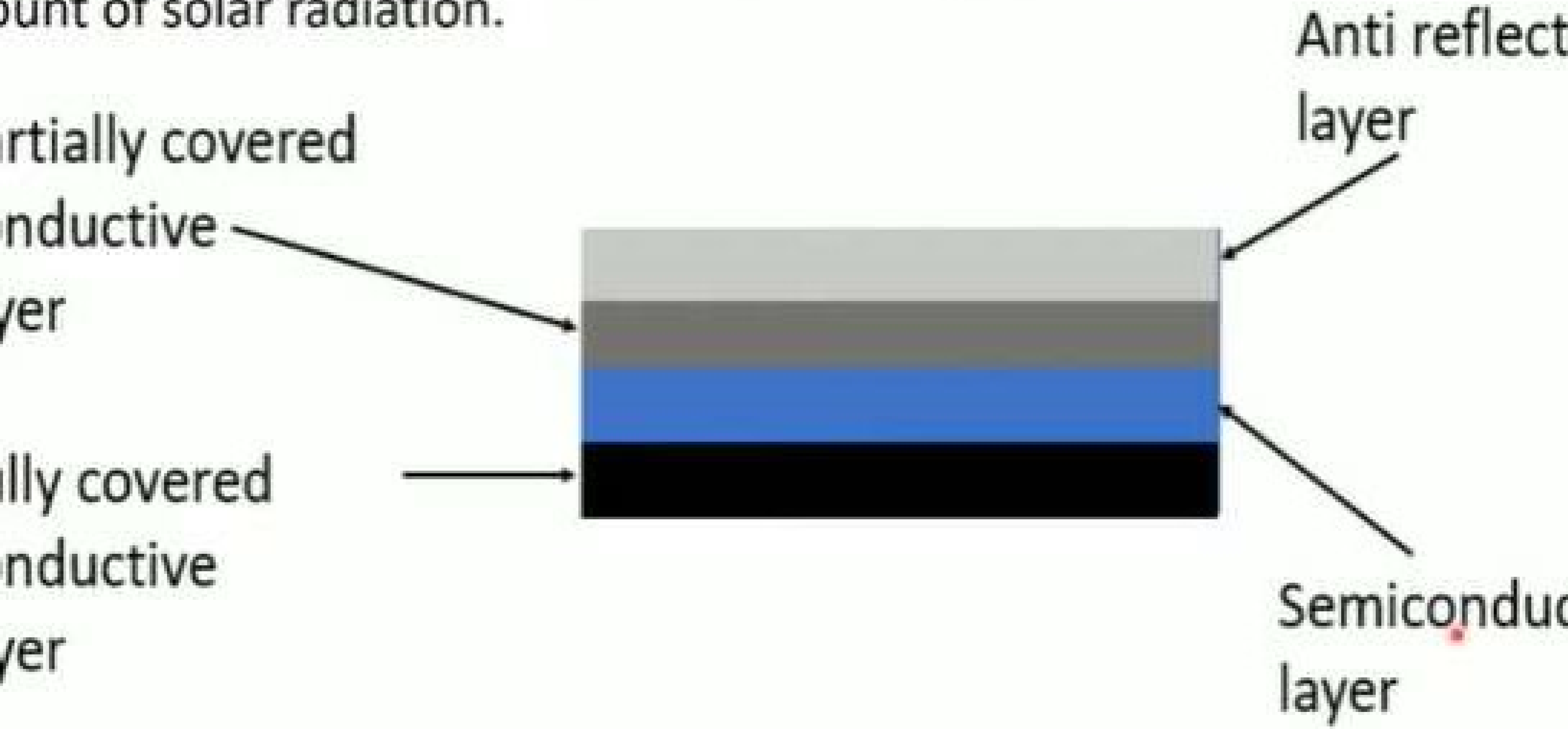
layer of conducting material is placed on the either side of the
emiconductor layer. The function of the conducting layer is to
ollects the electricity produced by the semiconductor layer.



noted that the backside of the semiconductor layer cell completely
ered with the conducting material, whereas the illuminated side of th
niconductor partially covered with conducting material to avoid blocki
much of the Solar radiation from reaching the semiconductor layer.



topmost layer is the anti-reflection coating layer to avoid reflection o
r radiation from the semiconductor layer. Because semiconductor lay
eflective in nature. The reflection causes losses. The only one solution
se layer/layers of an anti-reflection coating material to reduce the
ount of solar radiation.



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The semiconductor layer solar cell is composed of two different typ
of semiconductor layers.

A p-type layer and an n-type layer that are joined together to create
a p-n junction. We know that the p region has more holes than the
egion and n region has more electrons than p region. As a result,
when a p type and n type junctions combine together few electrons
from the n region move....

ght is composed of small bundles of electromagnetic radiation ener alled photons. When light energy of a suitable wavelength is incider n photovoltaic cells, the energy from the photon is transferred to ar ectron of the semiconducting material. So electrons of atoms get ufficient energy to jump to a higher energy state. This higher energy ate is known as the conduction band and the electrons are known ee electrons. These electrons are free to move through the materia nd it is this motion of the electron that creates an electric current ir ne solar cell.

solar photovoltaic cell generates electricity from sun light through following
ree general steps:

ight energy hit on the semiconductor layer and knocks electrons from atoms
ree electrons.

reating a current flow inside the solar cell.

his current is captured and transferred to out side the solar cell.

Solar Cell Efficiency

There are many factors that limit the efficiency of a solar cell. The semiconductors requires a minimum photon energy to excite an electron from its parent atom as a free electron. This energy is known as the band-gap energy. If a photon has less energy than the band-gap energy, the photon is absorbed as thermal energy by the atom. In the case of silicon, the band-gap energy is 1.12 electron volts.

he photon energy from the sun cover a wide range of energies.

ome of the incoming energy from the Sun does not have sufficient nergy to knock off an electron from the semiconductor atom.

he energy below the band gap energy is absorbed by the atoms anc nergy will be transferred to heat.

ven some of energies above the band-gap energy will be also ansformed into heat.

his reduces the efficiency again because that heat energy is not bei sed to produce electricity.

o the theoretical efficiency of silicon solar cells is about 33%.

There are ways to improve the efficiency of solar cells.

ncreasing the purity of the semiconductor

Jse Gallium Arsenide instead of silicon since Gallium Arsenide is
nore efficient than silicon.

lowever all of these methods are costly.

Solar cell construction materials

The most common material for commercial solar cell construction is Silicon, Gallium Arsenide, Cadmium Telluride and Copper Indium Gallium Selenide.