

quantum size effect

Unit - 3

QUANTUM SIZE EFFECT

QUANTUM CONFINEMENT:

The nano confinement is a process of quantum mechanics so that it is also known as "Quantum confinement". Quantum confinement refers to the facts to confine a particle into a small area of space for this energy is given to the particle. In other words "The deposition of the particles in small space with providing large energy is known as 'Quantum confinement'".

In this process a large amount of energy is required to restrict the particle in a particular location.

Quantum confinement is change of electronic and optical properties when the material sampled is of sufficiently small size typically in nano meters or less. The band gap increases as the size of nano

structure decreases. Specifically, the phenomena should result from electron & holes being squeezed into a dimension that approaches a critical quantum measurement called the "Bohr radius" when a nano structure is placed in strong electric field then the motion of nano particle is studied due to which the size of the substance decreases, which depend the conversion of nano substance into small substance in which the motion of nano particle is confined. The first experimental evidence of quantum confinement effect is given by optical nanostructure. They are

is obtain in etched, which obtain from crystalline CuCl. Also the study of absorption of X-ray in nano diamond thin film with grain diameter from 3.5 to 5 micrometers. Show the excitation condition blue valance band & conduction band due to which its size decreases and become 1.8nm. This particular size represent the confinement of nano particle in nano diamonds.

QUANTUM DOT:-

A quantum dot is a portion of matter, whose excitation are confine in all three dimension consequently. Such materials have electronic properties intermediate blue those of bulk semiconductor and of discrete molecule. The quantum dot are discovered by "Alexei and Louis E Brus" in 1980. Quantum dot are the part of solar cell, led, transistor and diode laser.

In simple words "Quantum dot are semiconductor whose electronic characteristics are related to the size, shape of the individual crystal".

As to the quantum confinement we know that the smaller size of the crystal the large is the band gap. It means that the difference blue higher valance band and lower conduction band is increases. So that more energy is

required to excite the dot material about more energy is released when the crystal returns to its resting state. The main advantage of quantum dot is of the high level of control possible over the size of the crystal produced.

APPLICATIONS:-

Quantum dots are particularly significant for optical applications due to their high extinction coefficient in electron application. They have been operated like a single electron transistor and show the Coulomb blockade effect. Quantum dots have also been suggested for quantum information processing.

The ability to tune the size of quantum dot is an advantage for many applications. We know that larger quantum dots have a greater spectrum compared to smaller dots on the basis of size. Quantum dots are classified into three parts known as "zero dimension, one dimension & two dimension". The zero dim. quantum dots have a sharper density of state than higher dim. structures. Also they have superior transport properties and are used in diode lasers, amplifiers & many other biological senses. Also quantum dots are useful in computing, photovoltaic device, LED & photodetector devices to increase the efficiency of such devices.

Quantum dot technology is one of the most promising device for use in solid state quantum computation. Also the efficiency and the cost of the photovoltaic cell is reduced by quantum dots.

It means that the quantum dot is a beneficial properties of nano technology which reduce the cost of different cells and increases its efficiency.