Physico-Chemical nanomaterials science

Electron energy in periodic quantum dots with different configurations

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Using the 0 dimensional quantum structures is very attractive because of the wide range of its applications as well as the prospects of replacing the inefficient and expensive materials. In the structure of quantum dots the insignificant energy can excite the states. The main parameter, that determine the energy or electrons in quantum dots (color of their radiation), is size of the dot – the parameter, that can be controlled by engineers with high accuracy. High light stability and brightness are typical for the radiation of quantum dots. The energy of particles in quantum dots is not influenced by the metabolic processes. It makes them promising in the examine of living cells. The periodic structure of quantum dots can be formed by dots of different shapes. Therefore the energy levels of particles can be determined by various configuration parameters, opening a large set of features influence the spectral properties of quantum dots. There are also several technological methods of preparing the system of quantum dots/ which are not complicated and quite economical: lithographic techniques (including laser lithography), epitaxial growth techniques, the band nanotechnology and colloid chemistry technology.

Usually quantum dots are rarefied in space, and electron energy in such systems resembles discrete electronic states, unlike it is in the macroscopic semiconductor materials, where electron energy forms quasi continuous spectrum with energy gap. The quantum dots can be formed like pyramids, spheres, cylinders or flattened drops. So we started our research with one-electron spectrum in the dots with various configurations and investigated the influence of these parameters on electron energy. Even for the simplest research (for spherically symmetry of dots) we see the considerable, strong impact of radius on electron energy (size of the dot). The periodic potential of the system of quantum dots (in the simplest rectangular form) leads to the appearance of energy gaps, which we applied to one-particle energy spectrum. Thus, we select only those energy levels, which do not overlap with energy gaps. These additional factors can be changed technologically, making the narrow emission spectra.