Nanooptics and nanophotonics

On the Determination of CdSe Quantum Dot Sizes

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The dependences of the energy E of the fundamental transition in CdSe quantum dots versus parameter $x = 10^4/a^2$ (a is the quantum dot radius) are analyzed on the basis of the experimental data [1-5]. The results obtained in [1,2] at 10K lead to substantially different dependences $E_1(x)$ and $E_2(x)$, respectively. It is easy to see that the curve $E_2(x/4)$ shifted along the vertical line for a certain distance with high accuracy coincides with the curve $E_1(x)$. This coincidence suggests that though everywhere in [2] the concept of quantum dot radius is used, the dot's diameter $d = 2a$ is actually assumed. The fact that the measurements performed in [3] at 300K lead to the $E_3(x)$ dependence, which coincides with the $E_1(x)$ dependence shifted upward by 90 *meV*, confirms that the $E_1(x)$ curve is correct. The equation $E_3(x) - 1.84\ eV \approx E_1(x) - 1.75\ eV$ shows that it is possible to extrapolate the results obtained at a certain temperature to the case of other temperature values by taking into consideration the temperature dependence of the forbidden gap of the bulk semiconductor. The dependences of the fundamental transition energy in CdSe quantum dots versus their size at 300K can be obtained form the results also published in [4,5]. The first one leads to the curve $E_4(x)$ located above $E_3(x)$, the second is presented by the curve $E_5(x)$ located below $E_3(x)$. The curves $E_4(x)$ - 50 *meV* and $E_5(1{:}3x)$ + 50 *meV* nearly coincide and are close to the curve $E_1(x)$.

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