Core/shell CdSe/ZnS and CdSeTe/ZnS quantum dots (QDs) with emission at 655, 705 and 800 nm have been studied using the photoluminescence (PL), PL dependence on excitation powers and Raman scattering in nonconjugated states and after the conjugation to different types of antibodies (ABs). Two types of ABs have been used: i) antihuman Interleukin-10 (IL-10) Rt IgG1 ABs, and ii) pseudo rabies virus (PRV) ABs. The transformation of PL and Raman scattering spectra, stimulated by the conjugated antibodies, has been studied. In all types of QDs at the bioconjugation the main PL band of QDs shifts in the “blue” high energy range. CdSeTe/ZnS QD energy diagrams were designed that helps to analyze the PL spectra and their transformations at the bioconjugation. It is revealed that the core in CdSeTe/ZnS QDs has the type II quantum well that permits to explain the near IR optical transition at 705 or 800 nm and its transformation at the bioconjugation with appearing the higher energy PL bands.

A set of physical reasons has been analyzed for the explanation of PL spectrum transformation at the bioconjugation, such as: i) emission of ABs or PBS buffer, ii) compressive strain applied to QDs at the bioconjugation, iii) core/shell material intermixing or oxidation, iv) changing the quantum-confined effect in QDs stimulated by the AB electric charge, v) dominated emission of excitons localized at the excited QD states or vi) changing the energy band profile in electric field of charged ABs.

Finally it is shown that the dominant reasons of emission transformation in bioconjugated CdSeTe/ZnS QDs are: i) changing the quantum-confined effect in QDs conjugated to charged ABs and ii) varying the energy band profile and shift of QD energy levels in an electric field of charged ABs. The effect of PL spectrum transformation is useful for the study of QD bioconjugation with specific antibodies. It can be a powerful technique in early medical diagnostics and can be used for improving the QD sensor sensitivity.

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Presenting author's email: ttorch@esfm.ipn.mx