# Optical Properties of InP-based Quantum Dots for O-band Laser Applications

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Optical fiber communication favors spectral ranges where the signal propagation is undisturbed over long distance. The O-band (original band: 1260-1360 nm) provides low transmission losses, offering at the same time very weak chromatic dispersion, limiting undesirable effects of pulse broadening and chirping. The data transmission through the optical fibers is driven by semiconductor lasers, using as an active material quantum wells or quantum dots. The development of the latter is particularly intense as the quantum dots in laser applications offer low threshold power with also low temperature sensitivity.

Here, we look at the InAs quantum dots developed as the active region of O-band-compatible lasers. The structures were grown by molecular-beam epitaxy on InP substrate, which became a universal material platform for quantum dots optically-active in O-band and C-band. One of the expected active region features are limited carrier losses, so the studied structures were grown with different compositions of InAlGaAs barrier surrounding active region, which was also grown with different number of quantum dot layers.

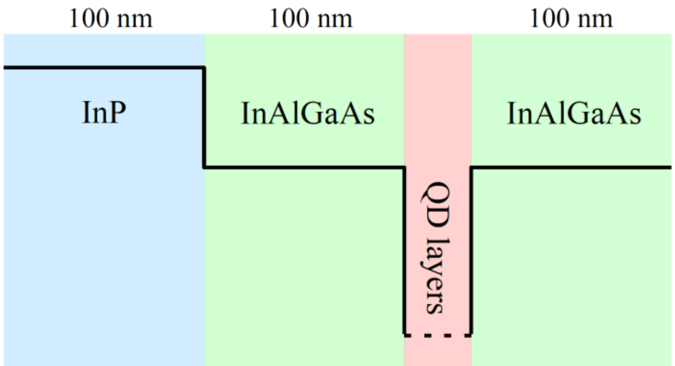


Fig.1. General scheme of the investigated QD structures

As one of the carrier escape routes is through quantum dot excited states, there is undertaken an attempt to derive information on the energetic separation between excited and ground quantum dot states. To derive the information on the energetic structure we use a few optical spectroscopy techniques: photoluminescence, photoreflectance and photoluminescence excitation. Photoluminescence spectra provide general emission properties and, in some cases, the excited states can also be observed. Photoreflectance is based on reflectance measurement where the electric field within the structure is periodically modulated by a laser beam. It gives information on the overall energetic structure of the studied material; however, its sensitivity is usually limited for quantum dot states. To complement these measurements there is also used photoluminescence excitation spectroscopy, which probes the energetic structure while monitoring directly quantum dot emission.