Study of Semi-Insulating Buried Heterostructure 1.3µm Electro-Absorption Modulated Laser

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We present here, as an integration target example, a simple BPSK TX PIC [1]. Its operation principle relies on two-arm inteferometric waveguide arrangement with optical phases 0-π prefixed by 1:2 MMI power splitter and DC-current controlled phase shifters. The waveguides are then combined in 2:1 MMI into a single output. Three different active regions made of AlGaInAs MQWs are defined in a single SAG epitaxial step by use of dielectric masks. Fig 1 shows the simulated photoluminescence wavelength for each photonic function area of a 1.5µm BPSK chip [2]. In 1.3µm designing we focus first on efficient laser and EAM as the most critical functions to integrate.

Simulations of AlGaInAs/InP strained QW system showed that large laser gain and T0 is obtained by a large energy separation between fundamental HH1 and HH2 hole levels. Large HH1-HH2 could only be obtained by reducing well width which is also beneficial to lower hole evacuation barrier HH1-LH3D. Therefore, we selected 3 cases of well thickness associated to lowest reasonable hole barrier: 8nm/90meV, 6nm/70meV and 5nm/45meV. Laser simulations (Fig 2) and broad area measurements showed that, in spite of barrier lowering, laser internal efficiency, gain and T0 improved for low well thickness. Expected EAM performance has been studied by photocurrent spectra giving access to QCSE shift and excitonic absorption strength represented in Fig 3. As expected, excitonic absorption enhances strongly with lower well width [3]. However, low hole barrier and well thickness reduce wavelength shift with bias of such EAMs.

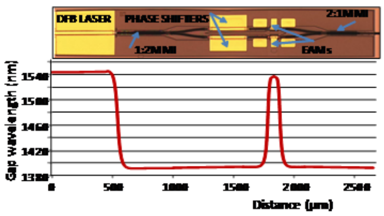

Fig 1. SAG PL design for each photonic function of a BPSK PIC

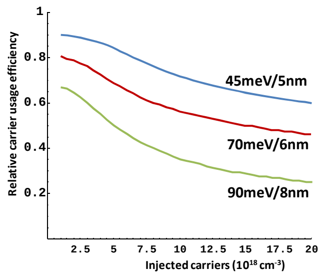

Fig 2. Simulated internal efficiency for three QW designs

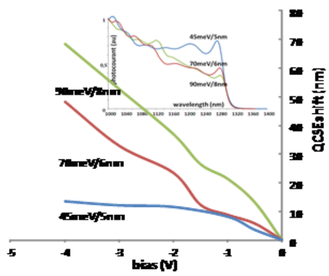

Fig 3. Measured QCSE shift and absorption spectra for 3 QW designs

We are developing a SAG integration platform with AlGaInAs QW system for 1.3µm PICs. Structures for efficient laser and modulator show best trade-offs for thin wells. This requires improving SAG reproducibility and precision to eventually provide predictive designing tools.

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