

Investigation of Ge/SiGe Quantum Well properties by room temperature photoluminescence

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Silicon photonics has become a mature integrated-optics technology in the last decade for applications in telecommunications and data communications. Germanium (Ge) is a group IV material compatible with CMOS foundry and interesting for silicon photonics because its direct gap energy corresponds to absorption band-edge at 1.55 μm wavelength. In addition despite being an indirect band gap material, direct gap-transitions can be used for photonic devices, thanks to the small energy difference between the indirect and direct bandgap energies. The potential of Ge/SiGe quantum wells (QW) has been largely shown recently, with for example demonstrations of electro-absorption and electro-refraction by Quantum Confined Stark effect. Ge/SiGe QW can also be engineered to shift absorption band-edge and thus the operating wavelength of optical modulator based on such structures.

In this context, experimental analysis of the material properties of Ge/SiGe QW structures and particularly direct gap optical transitions is of a major importance.

We will report room temperature photoluminescence of Ge/SiGe QW structures grown on SiGe graded layer. From the measurements, transition energies in the QW are deduced as a function of the QW design, and compared with simulations. A good agreement between photoluminescence measurements and simulations of the optical transitions in the QW is of a major importance to engineer new Ge/SiGe quantum well structures with innovative functionalities.