GaAsBi BASED NIR EMITTERS FOR BLOOD ANALYTE MONITORING

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Pulse oximetry is one of the areas where light emitting diodes (LED) and laser diodes (LD), with emission wavelengths of 660 nm and 940 nm are currently used. Such configuration experiences main drawbacks in reflectance oximetry mode due to the variation of penetration depth into soft tissue. An alternative set of wavelengths (800nm and 1100 nm) is proposed to eliminate the issue of difference in penetration depth, while maintaining an absorption difference for oxyhaemoglobin and non-oxygenated haemoglobin.

In this work we present results of technological development of LEDs and LDs operating in 1 μm – 1.2 μm spectral region. The material chosen for such devices was GaAsBi due to its temperature stability, room temperature (RT) operation, rapid band gap reduction of up to 90 meV/$\%_{Bi}$, and better strain management, when comparing to classical NIR materials.

Optimization of molecular beam epitaxy growth parameters for 3 - 5 GaAsBi rectangular quantum well (RQW) structures was carried out. Two devices on GaAs substrates buffered by an AlAs sacrificial layer were fabricated. GaAsBi RQW based LED with a central emission wavelength of 1070 nm at RT was produced. Moreover, an LD with 3 GaAsBi RQWs was fabricated and room temperature lasing at 1142 nm was recorded. Temperature dependentelectroluminescence showed stability of the emission wavelength for both devices.

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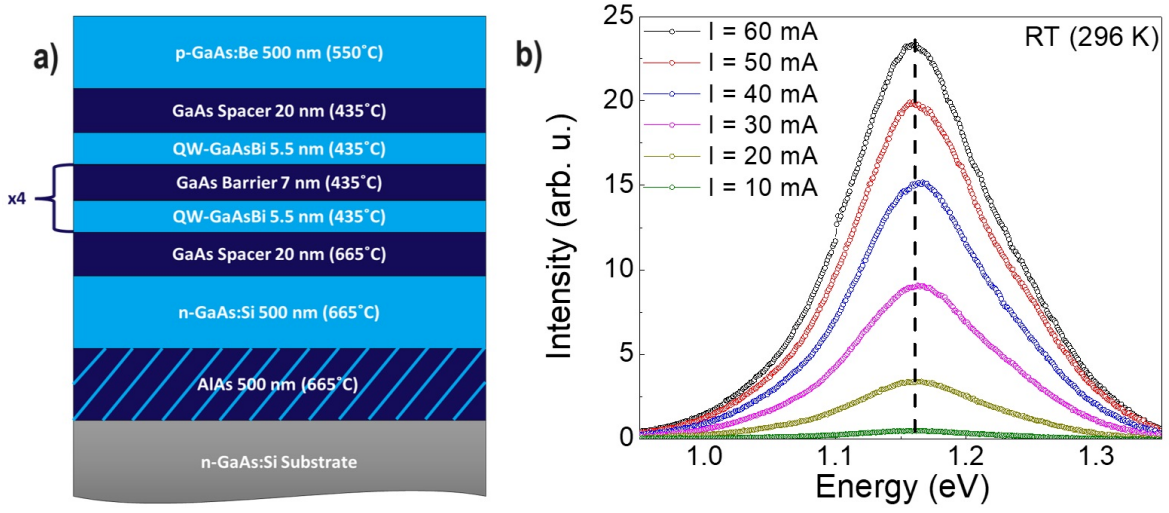

Fig. 1. a) GaAsBi 5xRQW LED structure. Growth temperatures provided from thermocouple readings. b) Excitation dependent RTEL measurement for GaAsBi 5xRQW LED (dashed line serves as eye guide).