GaSb-based laser diodes operating within the spectral range of 2-3.5 μm

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The latest advances in design and performance of Type I GaSb-based lasers will be discussed [1, 2]. We will focus on the performance of room-temperature (RT) operated lasers based on AlGaAsSb/ AlGaAsSb/GaSb and AlGaAsSb/InAlGaAsSb/GaSb compressively strained heterostructures. We will present the latest characterization results of Type I GaSb based lasers operating at RT in the 2.0–2.8 μm spectral range providing hundreds of mW of continuous-wave (cw) output power. Special attention will be paid to characteristics of GaSb based lasers operated above 3 μm at room temperature. The design and characteristics of GaSb-based Type I diode lasers with world record cw RT (290 K) output power of 120 mW at 3 μm, 60 mW at 3.1 μm and 15 mW at 3.35 μm (285 K) will be discussed – see Fig. 1. In short-pulse low duty cycle mode (200 ns/10 kHz) no devices show any thermal roll-over at 10 A, providing 1W, 500 mW and 250 mW peak power for 3 μm, 3.1 μm, and 3.36 μm laser diodes respectively.

We established that the increased valence band discontinuity of InAlGaAsSb QWs improved laser efficiency and device differential gain, and also minimized the contribution of Auger processes by reducing the threshold carrier concentration. The valence band offset energy between the barriers and QWs was increased utilizing quinternary AlInGaAsSb waveguide for development of 3 μm and 3.36 μm lasers and employing quaternary AlGaAsSb barriers with 0.35% Al for 3.1 μm devices. We used the high compressive strain (1.6–1.8%) in the QWs for all structures to further improve confinement of holes.

Our laser heterostructures were grown using a Veeco GEN-930 solid source molecular beam epitaxy system on GaSb substrates [3-5]. This work was supported by the NSF under grant DMR071054, US Air Force Office of Scientific Research under grants FA95500410372 and FA95500810083.

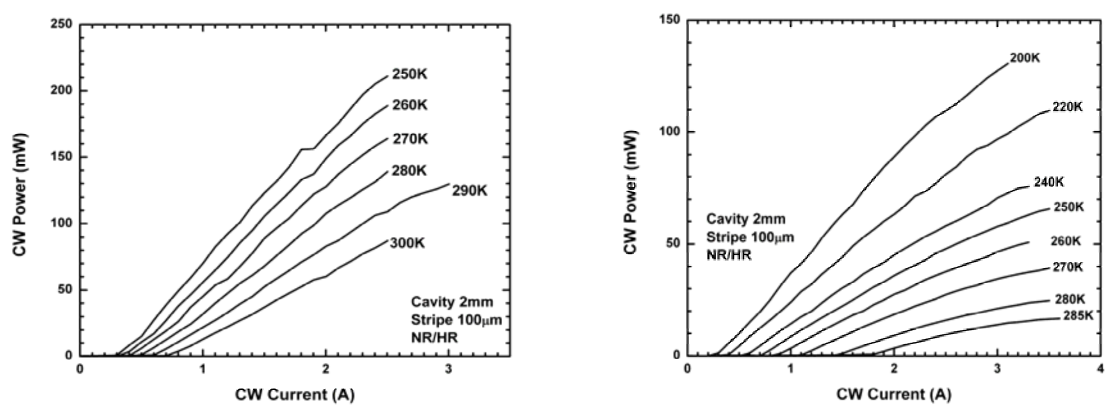

Fig. 1. Continuous-wave LI characteristics for 3.0 μm (290K) lasers (left) and 3.36 μm (285K) lasers (right).

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