Superluminescent diodes based on UV laser induced quantum well intermixing

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Integrated photonics and nanophotonics play an important role in the development of advanced telecommunication systems and innovative devices for life science research, diagnostics and therapeutic applications. Analogically to the developments taking place in the microelectronics industry, new functional devices and significant economic benefits have been expected from the advancements of integrated (nano)photonics. Superluminescent laser diode (SLD), which is an example of a monolithically integrated photonic device, is of high interest for communications and life science research applications involving chromatic dispersion measurement in fibers, testing of optoelectronic components, operation of fiber optic sensors and fiber optic gyroscopes, and optical coherence tomography. Fabrication of SLDs has been reported with a variety of epitaxial techniques as well as post-growth processes. However, fabrication of high-power SLDs at a cost-attractive level remains to be demonstrated.

In this communication, we investigate the advantage of a UV laser induced quantum well intermixing (UV-QWI) technique for fabrication of IR emitting SLDs. Experiments were carried out on InGaAs/InGaAsP QW laser heterostructures (λ=1.5 μm) using an ArF excimer laser (λ=193 nm, τ=15 ns) for irradiation of different sections of samples with different numbers of laser pulses. After the irradiation, the samples were annealed in a rapid thermal annealing (RTA) furnace at 700°C for 120 seconds. Different concentrations of surface defects induced with different doses of laser irradiation promoted selective area QWI during RTA. Broad area (FWHM > 115 nm) injection SLDs were fabricated from the QWI material. The results indicate that the UV-QWI technique is a relatively simple and efficient approach for the fabrication of high-quality SLDs based on InGaAs/InGaAsP QW heterostructures.

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