**II-VI/III-N based micro-chip green-yellow laser converters**

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**Abstract**—We report on recent progress in developing green-yellow II-VI/III-N laser converters comprising low-threshold (nGaN LD, mounted in a micro-chip package. Novel design and technological approaches in further reducing threshold power density of the II-VI structures and extending their wavelength to yellow range are discussed.

Recent fabrication of cw InGaN laser diodes (LDs) on semi-polar (11-22) GaN substrates, emitting at a wavelength up to 536 nm [1] and exhibiting the 5000 h lifetime for the range λ=525-530 nm [2], has been a real breakthrough in development of green semiconductor lasers. Nevertheless, the “true” green (530-550 nm) and yellow-green (555-590 nm) ranges of the visible spectrum are still unreachable for III-N LDs at this stage, and one can expect strong limitation of their output power for this ranges in the future. Therefore, the restart of II-VI green-yellow LDs development [3] as well as search for alternative competitive ways of obtaining efficient compact green-yellow laser emitters are still of a great importance. Elaboration of high-efficiency Cd(Zn)Se/ZnMgSSe laser heterostructures with a CdSe quantum dot (QD) active region and a superlattice graded-index waveguide (GIW), grown by MBE on GaAs(001) [4], which can be pumped optically by the emission of commercial high-power blue-violet InGaN LDs (416 nm, \(P_{\text{exc}}\sim1\ W\), TopGaN) has resulted in demonstration of the II-VI/III-V LD converters emitting in green (\(\lambda=543\ \text{nm}\)) with the maximum pulse output power of 154 mW and quantum conversion efficiency of \(\eta=25.4\%\) [5].

This paper reports on progress in further developing the optically-pumped yellow-green II-VI QD laser structures with the threshold power density well below 1 kW/cm² (300K). In particular, special attention will be paid to reduction of point defect density in the CdSe/ZnSe QD active region usually grown in strongly non-equilibrium conditions, as well as to extending lasing wavelength to the yellow range (beyond 580 nm) with the use of ZnCdSe matrix for CdSe QDs and employing an elastic strain compensation concept. As a result, green (530-550nm) and yellow-green (565-580 nm) micro-chip LD converters based on blue-U440 pumping InGaN LDs, cylindrical micro-lens, and a TO-18 package will be demonstrated which exhibit the output power above 1 W (at \(\tau_{\text{pulse}}=4\ \text{ns}, \eta\sim14\%\)) and 160 mW (at \(\tau_{\text{pulse}}=200\ \text{ns}\)) in green and above 90 mW (at \(\tau_{\text{pulse}}=200\ \text{ns}\)) in yellow-green at room temperature. Possibility of exploiting high-brightness blue InGaN LEDs for fabrication of II-VI/III-N LD converters will be discussed as well.