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Near-field Optical Characterization of Visible Multiple Quantum Well Semiconductor Lasers

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Abstract

Both collection and excitation modes of scanning near-field optical microscopy (SNOM) were used to study a low power visible multiquantum-well laser diode (LD). Collection mode SNOM provides the near-field optical propagating intensity distribution at the facet of LD. Excitation mode SNOM gives local photoconductivity information of the structure of LD facet. Results show highly localized spatial correlation of LD structure and its optical performance at the facet. Different sizes of apertures were used in both modes, and results of near-field interactions can be quite different. Results show obvious difference of photocurrent distribution caused by the different sizes of apertures in excitation mode. Two wavelengths of 543.5 nm and 632.8 nm were used in excitation mode SNOM. It can be deduced from the two pump photon energies that there exists defect level in the energy range of 60 - 380 meV below the conduction band edge in the n-(Al0.7Ga0.3)0.5In0.5P cladding layer. In addition to the highly localized images of topography, optical output, and optical beam induced current at the facet of LD, local near- field optical spectroscopy was performed as well. Spatially resolved near-field optical spectra of both stimulated and spontaneous emissions were obtained at the facet of LD. Longitudinal modes of stimulated emission of LD were observed locally.